Issued May 1968

SOIL SURVEY

PIERCE COUNTY

Wisconsin

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
UNIVERSITY OF WISCONSIN
Wisconsin Geological and Natural History Survey
Soil Survey Division
and
Wisconsin Agricultural Experiment Station

Major fieldwork for this soil survey was done in the period 1957 to 1961. Soil names and descriptions were approved in 1965. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1963. This survey was made cooperatively by the Soil Conservation Service and the Wisconsin Geological and Natural History Survey, Soil Survey Division, and the Wisconsin Agricultural Experiment Station, University of Wisconsin, as part of the technical assistance furnished to the Pierce County Soil and Water Conservation District.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY of Pierce County, Wis., contains information that can be applied in managing farms and woodlands; in selecting sites for roads, ponds, buildings, or other structures; and in appraising the value of tracts of land for farming, industry, or recreation.

Locating Soils

All of the soils of Pierce County are shown on the detailed map at the back of this survey. This map consists of many sheets that are made from aerial photographs. Each sheet is numbered to correspond with numbers shown on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbol. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information in the survey. This guide lists all of the soils of the county in alphabetic order by map symbol. It shows the page where each kind of soil is described, and also the page for the capability unit, woodland group, or any other group in which the soil has been placed.

Individual colored maps showing the relative suitability or limitations of soils for many specific purposes can be developed by using the soil map and information in the text. Interpretations not included in the text can be developed by grouping the soils according to their suitability or limitations for a particular use. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils in the soil descriptions and in the discussions of the interpretative groupings.

Foresters and others can refer to the section "Woodland Uses of the Soils," where the soils of the county are grouped according to their suitability for trees.

Engineers and builders will find, under "Engineering Uses of the Soils," tables that give engineering descriptions of the soils in the county and that name soil features that affect engineering practices and structures.

Scientists and others can read about how the soils were formed and how they are classified in the section "Genesis, Morphology, and Classification of Soils."

Students, teachers, and others will find information about soils and their management in various parts of the text.

Newcomers in Pierce County may be especially interested in the section "General Soil Map," where broad patterns of soils are described.

Cover Picture: **Field strips and contour stripcropping on a farm in Pierce County.**

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NOTICE TO LIBRARIANS

Series year and series number are no longer shown on soil surveys. See explanation on the next page.

Issued May 1968

EXPLANATION

Series Year and Series Number

Series year and number were dropped from all soil surveys sent to the printer after December 31, 1965. Many surveys, however, were then at such advanced stage of printing that it was not feasible to remove series year and number. Consequently, the last issues bearing series year and number will be as follows:

Series 1957, No. 23, Las Vegas and Eldorado Valleys Area, Nev.
Series, 1958, No. 34, Grand Traverse County, Mich.
Series 1959, No. 42, Judith Basin Area, Mont.
Series 1960, No. 31, Elbert County, Colo. (Eastern Part)
Series 1961, No. 42, Camden County, N.J.
Series 1962, No. 13, Chicot County, Ark.
Series 1963, No. 1, Tippah County, Miss.

Series numbers will be consecutive in each series year, up to and including the numbers shown in the foregoing list. The soil survey for Tippah County, Miss., will be the last to have a series year and series number.

SOIL SURVEY OF PIERCE COUNTY, WISCONSIN

BY ORVILLE L. HASZEL, SOIL CONSERVATION SERVICE

FIELDWORK BY DALE E. PARKER, DELBERT D. THOMAS, AND GORDON N. WING, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY, SOIL SURVEY DIVISION, AND THE WISCONSIN AGRICULTURAL EXPERIMENT STATION, UNIVERSITY OF WISCONSIN

PIERCE COUNTY is in the west-central part of Wisconsin (fig. 1). It is bordered on the west by the St. Croix River (Lake St. Croix) and on the south by the Mississippi River. On the east it is bordered by Dunn and Pepin Counties, and on the north by St. Croix County. The total land area is 378,240 acres.

The county has 17 civil townships, but it contains no large cities. The largest urban area, River Falls, is partly in St. Croix County. Ellsworth, the county seat, is centrally located. The population of the county was 22,503 in 1960. About 50 percent of the workers in the county are engaged in activities related to farming, and an additional 15 percent are engaged in wholesale or retail trade. Still others are engaged in manufacturing.

Nearly 89 percent of the acreage in the county was in farms in 1959,[1] and most of the land suitable for cultivation is now used for field crops or pasture. About a fourth of the acreage is wooded.

Farming, based primarily on dairying, is, by far, the most important enterprise in the county. The dairy farms are generally diversified, and the dairy farmers raise swine, sheep, and poultry in addition to keeping dairy cattle. Cash crops are grown on a few farms, but the field crops are fed mainly to the dairy cattle or to other kinds of livestock.

Corn grown for grain or forage, and also hay and oats, are the main field crops. Soybeans are important, and pasture occupies a large acreage. The most important hay crop is alfalfa, but mixed clover and timothy are also grown extensively for hay. Oats are generally grown as a nurse crop for hay.

Farm products are the basis of practically all of the trading and manufacturing in the county. The farms supply dairy products to the creameries located in Ellsworth and Elmwood, and they supply milk to the milk-processing plant in Spring Valley. The output of cheese has increased considerably over the years. More emphasis has been placed on producing butter, however, than on producing cheese. This county is now a part of the most important creamery area in Wisconsin.

Additional industries in the county are the processing of maple sirup and other forest products. The forests, however, not only supply maple sirup and wood for the farms, but they also provide recreation and some cash income from the sale of wood products. The larger plants for processing lumber and other wood products are near Spring Valley.

Figure 1.—Location of Pierce County in Wisconsin.

[1] From figures of the U.S. Bureau of the Census for 1959.

The tourist industry is of increasing importance in the western part of the county. For tourists and others, the wet areas along the Mississippi River provide places to fish, and they provide other types of recreation. Commercial fisherman also take fish from Lake Pepin and Lake St. Croix, and those fish are shipped as far east as New York City.

The county has a large acreage of soils suitable for farming. Most of the soils are moderately deep or deep, and some are nearly level or gently sloping. Others are sloping, and some soils that border the larger streams are steep and stony. Most of the soils are silty or loamy, but some are sandy. Field crops grown on the soils of this county respond to applications of lime and fertilizer.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soils are in Pierce County, where they are located, and how they can be used.

They went into the county knowing they likely would find many soils they had already seen, and perhaps some they had not. As they traveled over the county, they observed steepness, length, and shape of slopes; size and speed of streams; kinds of native plants or crops; kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by roots of plants.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. To use this survey efficiently, it is necessary to know the kinds of groupings most used in a local soil classification.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Dubuque and Sparta, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that go with their behavior in the natural, untouched landscape. Soils of one series can differ somewhat in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man.

Many soil series contain soils that differ in texture of their surface layer. According to such differences in texture, separations called soil types are made. Within a series, all the soils having a surface layer of the same texture belong to one soil type. Dakota sandy loam and Dakota loam are two soil types in the Dakota series. The difference in texture of their surface layers is apparent from their names.

Some types vary so much in slope, degree of erosion, number and size of stones, or some other feature affecting their use, that practical suggestions about their management could not be made if they were shown on the soil map as one unit. Such soil types are divided into phases. The name of a soil phase indicates a feature that affects management. For example, Derinda silt loam, 0 to 2 percent slopes, is one of several phases of Derinda silt loam, a soil type that ranges from nearly level to steep.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodland, buildings, field borders, trees, and other details that greatly help in drawing boundaries accurately. The soil map in the back of this survey was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning management of farms and fields, a mapping unit is nearly equivalent to a soil type or a phase of a soil type. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil type or soil phase.

In preparing some detailed maps, the soil scientists have a problem of delineating areas where different kinds of soils are so intricately mixed and so small in size that it is not practical to show them separately on the map. Therefore, they show this mixture of soils as one mapping unit and call it a soil complex. Ordinarily, a soil complex is named for the major kinds of soil in it, for example, Edith-Wykoff soils. Also, most surveys include areas where the soil material is so rocky, so shallow, or so frequently worked by wind and water that it cannot be classified by soil series. These areas are shown on a soil map like other mapping units, but they are given descriptive names, such as Steep stony and rocky land or Riverwash, and are called land types.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soils in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soils. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in a way that it is readily useful to different groups of readers, among them farmers, managers of woodland, engineers, and homeowners. Grouping soils that are similar in suitability for each specified use is the method of organization commonly used in soil surveys. On basis of the yield and practice tables and other data, the soil scientists set up trial groups, and then test them by further study and by consultation with farmers, agronomists, engineers, and others. Then, the scientists adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Pierce County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of farming or other land use. Such a map is not suitable for planning the management of a farm or field, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect management. The soil associations in Pierce County are discussed in the pages that follow.

1. Dakota-Waukegan Association

Moderately deep, dark-colored, loamy soils of stream terraces

This soil association occupies broad stream terraces in the northwestern corner of the county, and terraces of the Trimbelle and Big Rivers. It makes up about 8 percent of the total land area in the county.

The principal soils are those of the Dakota and Waukegan series (fig. 2). Those soils are moderately deep loams and silt loams underlain by sandy material. For the most part, they are gently sloping. The Dakota and Waukegan soils formed under a cover of prairie grasses and scattered oaks, and they are dark colored. The Waukegan soils are more silty than the Dakota.

Less extensive in this association are the dark-colored Rockton and Hesch soils. The Rockton soils occur where limestone bedrock is near the surface. The Hesch soils occupy the lower slopes of the sandstone hills that rise above the terraces. They are gently sloping to steep and formed in material weathered from sandstone.

Minor acreages are made up of light-colored Lamont, Renova, Boone, and Hixton soils. The Lamont soils occupy a narrow area bordering the Mississippi and St. Croix Rivers, where they formed in windblown sand. They range from moderately steep, where they occur on the river banks, to gently rolling, dunelike, or hummocky on the terraces. Gently sloping to moderately steep Renova soils occupy the tops of the sandstone hills. Boone soils are on the steep side slopes, and gently sloping to steep Hixton soils are on the lower slopes. All of the light-colored soils formed under a cover of trees.

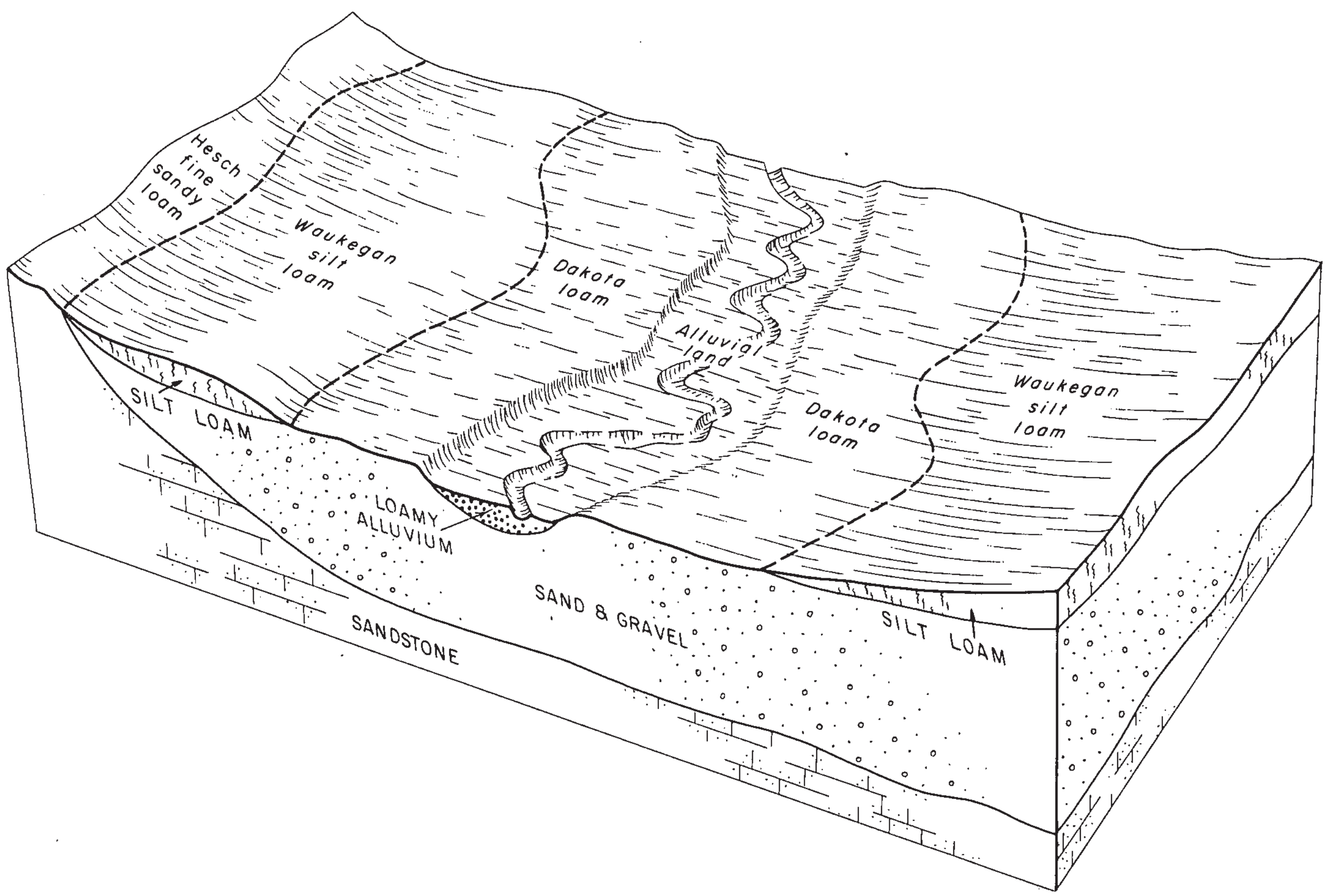

Figure 2.—**Cross section of association 1 showing the topography, the major soils, and the underlying material.**

Many of the soils of this association have layers of loamy material within their substratum of loose, sandy material. These loamy layers are common in the substratum of soils in the valleys of the Trimbelle and Big Rivers. They are especially prevalent in the soils near hills and ridges capped with limestone.

The Dakota and Waukegan soils, and others in this association, are well suited to crops. Yields are generally good if enough rainfall is received, and if the rainfall is well distributed. Many of the soils, however, are somewhat droughty, and some are susceptible to wind erosion.

2. Antigo-Onamia Association

Moderately deep, light-colored, loamy soils of stream terraces

This soil association occupies the terrace of the Kinnickinnic River in the northwestern corner of the county, and it also makes up a part of the Mann Valley. The terrace consists of a shelf of bedrock cut by a gorge through which flows the Kinnickinnic River. On this terrace have been deposited various thicknesses of outwash and loess that overlie the bedrock. The association occupies about 2 percent of the county.

Moderately deep Antigo and Onamia soils are dominant in this association (fig. 3). They are silty or loamy and are underlain by sand and gravel. For the most part, they are on the nearly level or gently sloping parts of the terrace in the western part of the association.

Dubuque, Tell, and Meridian soils also occur in this association, but less extensively than the Antigo and Onamia soils. The Dubuque soils are near the edge of the terrace, where limestone bedrock is near the surface. The Tell and Meridian soils, which have formed in thicker deposits of soil material than the Dubuque, are between the edge of the terrace and the gentle lower slopes of the adjacent hills.

Another minor part of this association consists of Rockton and Whalan soils and of areas of Terrace escarpments, Steep stony and rocky land, and Alluvial land. Still another minor part is made up of Chetek, Edith, Wykoff, Lamont, and Plainfield soils. The gently sloping to moderately steep Rockton soils, and some areas of Whalan soils, are on the edge of the terrace and along the ravines that dissect the rock shelf. Areas of Terrace escarpments and of Steep stony and rocky land make up the walls of the gorge, and areas of Alluvial land are dominant on the bottoms along the streams.

The Chetek, Edith, and Wykoff soils are on the dissected rolling to hilly outwash plain in the extreme northwestern corner of the soil association. They are generally shallower or coarser textured than the soils in other parts of the association. Those soils and the Onamia soils in this part of the association have a loamy or sandy surface layer and an extremely leached, gravelly substratum. The Lamont and Plainfield soils occur near the edge of the terrace above the St. Croix River. The

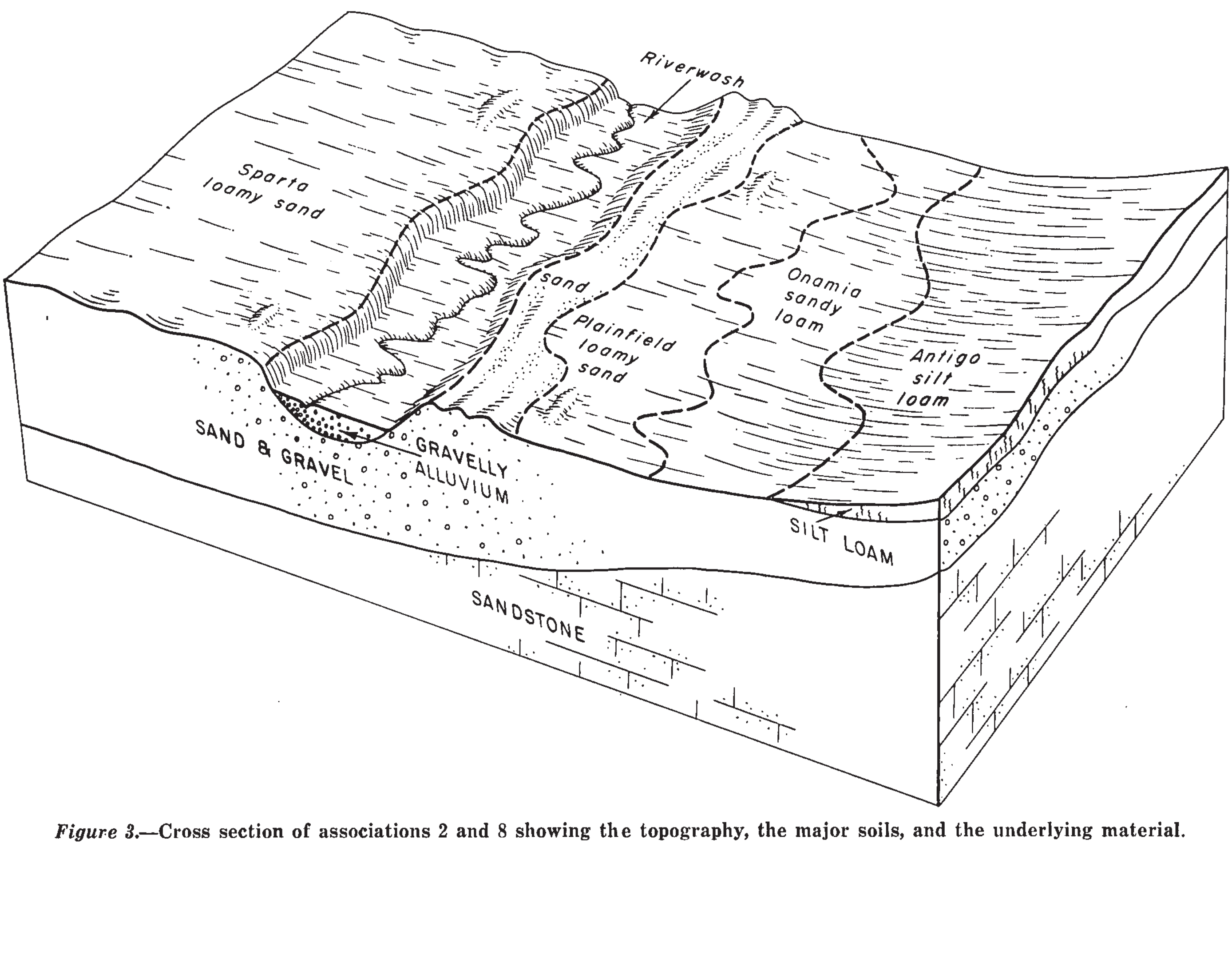

Figure 3.—**Cross section of associations 2 and 8 showing the topography, the major soils, and the underlying material.**

Lamont soils formed in material deposited by wind, and the Plainfield soils, in material deposited by water.

The soils of this association that formed in outwash—the Meridian and Tell, for example, and to a lesser extent, the Antigo and Onamia—have layers of loamy material within their substratum of loose, sandy or gravelly material.

The major soils of this association, and some of the minor soils, are suitable for crops. The soils are slightly droughty during extended periods of dry weather, but the ones that have loamy material within the substratum are less droughty than the others. The soils in the dissected area in the extreme northwestern part of the association are generally suited to pasture and trees. The slopes in that part of the association are steep and irregular, and the soils are coarser textured, shallower, and more droughty than in other places. Practices that conserve the soils and water are difficult or impractical to apply.

3. Derinda-Schapville Association

Moderately shallow, silty soils underlain by neutral to calcareous shale

This association is characterized by gently sloping to steep ridgetops—some broad, some narrow—and by narrow, steep-walled valleys. All of the ridgetops are capped with shale. The shale, in turn, is covered by a layer of glacial till and by windblown silty material (loess). The association is divided into two parts by the valley of the Trimbelle River. It occupies about 2 percent of the county.

A major part of this association consists of Derinda, Schapville, Renova, and Vlasaty soils (fig. 4). In many places Derinda soils and their dark-colored associates, the Schapville soils, occur toward the outer edges of the ridgetops. In those areas the layer of glacial till is thin or absent and the mantle of silty material directly overlies the shale. Wet subsoil variants of the Schapville series occur in the less sloping parts of the association, where the cover of windblown material is thin and a perched water table is near the surface.

In the wet subsoil variants of the Schapville series, percolating water collects above the layer of slowly permeable shale or clay that underlies the blanket of silty material. The water moves laterally along the top of the slowly permeable layer until it reaches an outlet along the marginal breaks. Here, along the fringe of the perched water table, moisture passes upward by capillary action into the overburden of soil material. The additional moisture favors more luxuriant growth of plants,

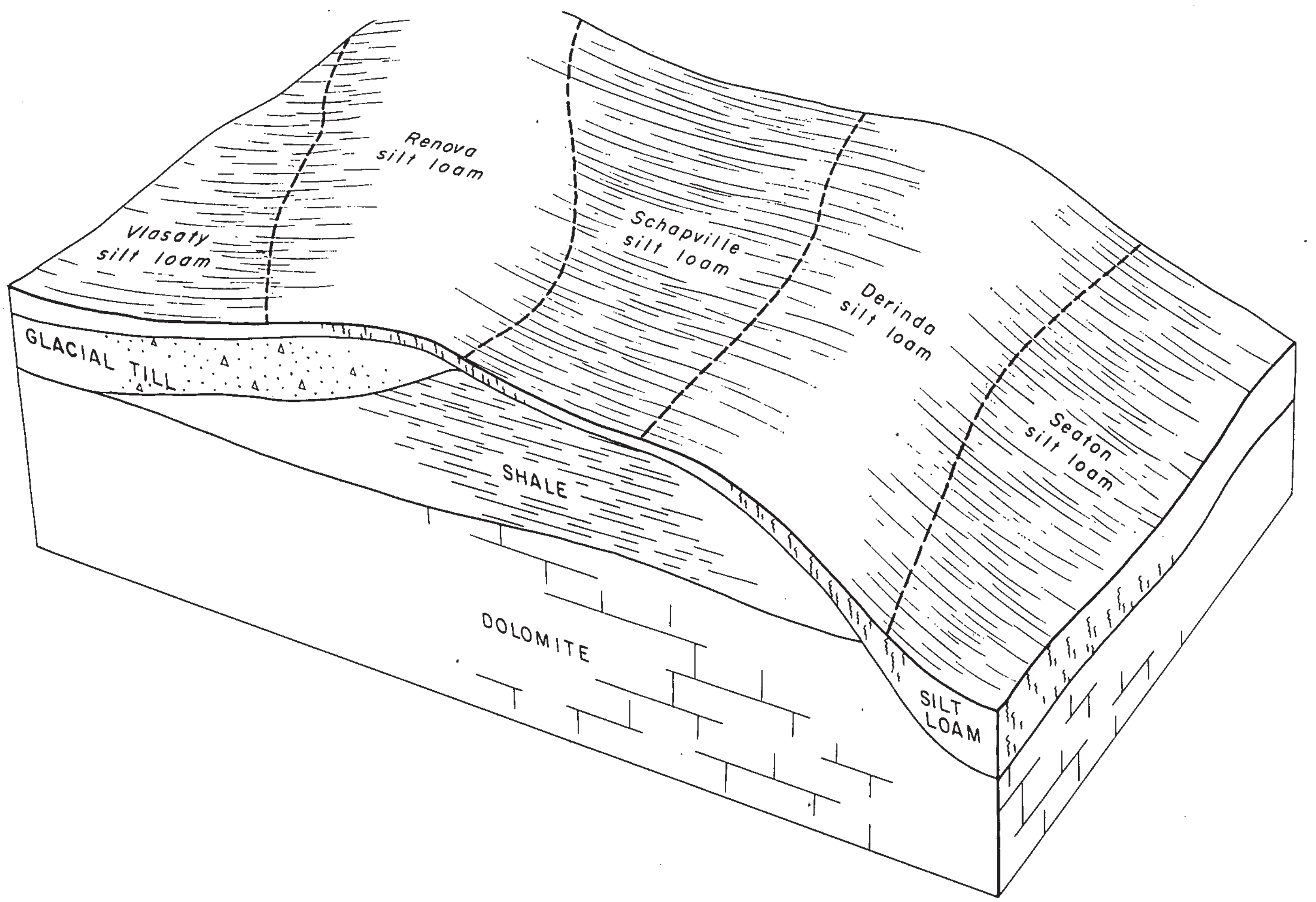

***Figure 4.*—Cross section of associations 3 and 5 showing the topography, the major soils, and the underlying material.**

which, in turn, contribute more organic matter to the soils.

The Renova are well-drained soils on the central and highest parts of ridges, generally on the steeper convex slopes. The Vlasaty soils are in areas marginal to those occupied by the Renova soils, at a slightly lower elevation, and mainly on gentle, concave slopes.

Minor acreages in this association are occupied by the Seaton, Wykoff, and Sargeant soils. The Seaton soils are in positions similar to those occupied by the Renova soils, and are well drained. Wykoff soils are on the steeper hilltops. The Sargeant soils are in the lower parts of this association and are somewhat poorly drained. They formed in a mantle of windblown silt that overlies glacial till. The Sargeant soils receive both runoff and seepage waters.

In this association the Seaton, Renova, and Vlasaty soils are the best for farming. They are suited to all the crops commonly grown in the area. The Wykoff soils are slightly less suitable for crops because they are generally steeper and are slightly more droughty than the Seaton, Renova, and Vlasaty soils. The Derinda and Schapville soils have limited depth, and as a result, are not well suited to deep-rooted crops. The Sargeant soils and the wet subsoil variants of the Schapville series generally have slopes that are more gentle than those of the other soils. Excess water is a hazard in the less sloping areas of those soils.

Most of the soils of this association are used for crops. Where the soils are too steep for cultivation, however, they are used mainly for meadow, permanent pasture, or trees, and a small acreage is idle. The native forest in the wooded areas consists of upland hardwoods.

4. Derinda, Acid Variant-Gale, Thin Solum Variant, Association

Moderately shallow, silty soils underlain by acid shale, siltstone, and sandstone

This association consists mainly of sloping to steep soils in a valley located in the upper reaches of the watershed of Plum Creek. It also includes soils on the ridgetops that surround the valley. Typical of the landscape in the association are rounded hills covered by silty material. The soils are underlain by acid shale or by siltstone and sandstone bedrock. The association occupies about 2 percent of the county.

This association is unique in Pierce County, for where the extremely acid shale is near the surface, the soils are acid. This acid reaction has a marked influence on the management of the soils and crops. The association is also unique in the fact that in the geologic past the area that now makes up this association was the site of a disturbance that caused a vertical displacement of the bedrock. The fault line caused by this displacement extends southeast-northwest across the southern part of the association. Along this fault line in some parts of the association, the bedrock on one side of a hill is of an entirely different kind than that on the other side, although both kinds of bedrock are at the same elevation.

A major part of this association consists of acid variants of the Derinda series and of thin solum variants of the Gale series (fig. 5). Both the Derinda and Gale variants are on the steep side slopes of ridges that surround the valley, and they are also on the sides of hills within the valley. The acid variants of the Derinda series occur at various elevations, immediately below the thin solum variants of the Gale series. The thin solum variants of the Gale series are on east-facing slopes at elevations of 1,020 to 1,040 feet. In the areas where these variants occur, the soils have been influenced by the underlying shale or by siltstone or sandstone. Some of the soils of these areas are similar in many respects and are so intermingled that they could not be mapped separately.

The acid variants of the Derinda series are closely related to the Derinda soils of association 3. They formed in silty material over acid shale, however, instead of in silty material over neutral to calcareous shale. Like the Derinda soils of association 3, the acid variants are locally important for farming, although they are not extensive.

A minor part of this association is occupied by Gale and Boone soils, which occupy only small acreages; by Seaton, Otterholt, Spencer, Renova, and Vlasaty soils; and by areas of Alluvial land. The Seaton soils are mainly gently sloping to sloping and are in valleys. They occur mainly where the mantle of loess is deep over shale. Moderately well drained or well drained Otterholt, Spencer, Renova, and Vlasaty soils are on the ridgetops surrounding the valley, where they formed in deep or moderately deep, silty material over loam glacial till. The areas of Alluvial land are in drainageways.

The soils in a large part of this association are better suited to the production of forage crops or trees than to field crops. The Otterholt, Spencer, Renova, and Vlasaty soils are better suited to field crops than the other soils. The Seaton soils, however, are also highly desirable for crops, but the Gale and Boone soils are less suitable. Some soils of the association are too shallow or droughty to be well suited to crops, and the steep slopes, bedrock near the surface, or erosion make some valley soils unsuitable. Large applications of lime are required for average yields in areas where the mantle of silty material is thin and the acid shale near the surface makes the surface layer acid.

5. Renova-Vlasaty Association

Moderately deep, silty soils underlain by yellowish-brown, acid till

This soil association consists of gently rolling to steep upland ridges, very steep bluffs, narrow valleys, sandstone hills, and broad valleys. It occupies about 30 percent of the total land area of the county. The soils in most of the association are underlain by a layer of yellowish-brown glacial till that caps the bedrock of limestone or sandstone. The till is most common on the hills and ridgetops, but it also extends into the broad valleys. Most of the soils formed partly in the till and partly in windblown silty material (loess) that forms a mantle over the till. Throughout most of this association are light-colored soils formed under a cover of trees. In the extreme western part, however, some dark-colored soils are intermingled with the light-colored ones. The dark-colored soils have formed in areas, called oak openings, where the cover consisted partly of grass and partly of trees.

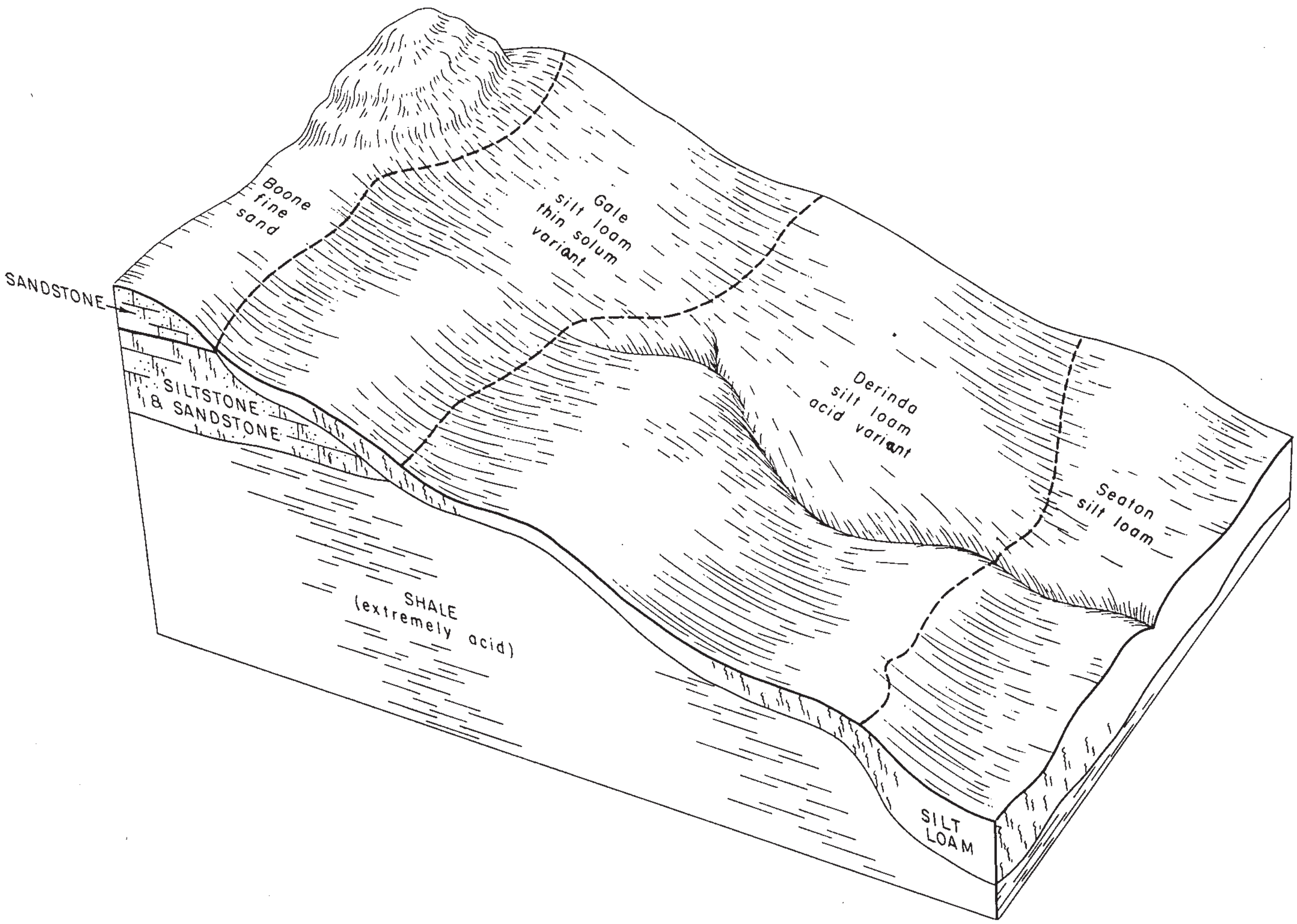

Figure 5.—**Cross section of association 4 showing the topography, the major soils, and the underlying material.**

A major part of this association is occupied by Renova and Vlasaty soils (see fig. 4). Those well drained or moderately well drained soils occur at the highest elevations on the ridgetops in the uplands.

Minor areas of Wykoff soils also occur on the ridgetops. In addition, small, isolated patches of Santiago soils occur there at the highest elevations, and areas of Otterholt and Spencer soils occur where the mantle of silty material is thickest.

Minor acreages of this association are occupied by soils of the Edith-Wykoff complexes; by somewhat poorly drained Sargeant and Almena soils; by areas of Alluvial land; and by Chaseburg, Worthen, Auburndale, and Clyde soils. The association also includes areas of Arland, Boone, Gale, Hixton, Seaton, Whalan, Edith soils mapped separately, and Port Byron, Ostrander, Racine, and Floyd soils, as well as small, isolated patches of Derinda and Schapville soils.

The soils of the Edith-Wykoff complexes are on the steeper hills and gravelly moraines. The Sargeant and Almena soils are lower in the soil pattern, on gentle, mainly concave slopes. The areas of Alluvial land and of Chaseburg, Worthen, Auburndale, and Clyde soils are in the upland drainageways.

The soils of the Arland, Boone, Gale, and Hixton series occupy areas of sandstone hills, mostly east and south of Ellsworth. The Arland soils occur on the tops of the hills with Renova and Whalan soils; Boone soils are on the side slopes of the hills; and gently rolling Gale and Hixton soils occur with Seaton soils in the gently rolling, broad valleys. All of these soils have formed in material weathered from sandstone bedrock or are underlain by sandstone bedrock. They range from well drained and fertile to excessively drained and infertile.

Shallow, gravelly Edith loams are on the hills in the extreme western part of this association. Dark-colored Port Byron, Ostrander, and Racine soils generally occupy the lower side slopes of the hills, and gently rolling areas of those soils occupy the broad valleys. Somewhat poorly drained Floyd soils are in the drainageways. The small areas of Derinda and Schapville soils are near Ellsworth and near areas of soil association 3.

Cultivated crops are grown on the soils of most of the ridgetops and valleys. The steep side slopes of the ridges and hills are mainly in trees, but some of those steep areas are pastured. The cover of trees is sparse in the western part of the association.

Where the deep, silty soils are properly farmed, yields of crops are generally good. The moderately deep soils are only slightly less productive than the deep soils, but the shallow soils have been more adversely affected by erosion. Droughtiness is not a major problem in this asso-

ciation, for the acreage of excessively drained soils is not extensive. Gully erosion is a serious hazard, however, where runoff from the ridges flows down the bluffs and valley walls.

On many of the farms in this association, the kinds of soils and slopes vary greatly and there is a wide range in the degree of erosion. On those farms, management is more complex than on farms where the soils are more nearly uniform.

6. Seaton-Dubuque Association

Dominantly deep, silty soils over dolomite

This soil association consists of narrow, gently rolling upland ridges of dolomite covered by a mantle of windblown silty material. It also contains very steep bluffs and narrow areas of stream terraces and bottom lands. The ridgetops in the uplands are occupied by soils that are deep, silty, and well drained. The steeper side slopes of the ridges, next to the bluffs, are occupied by moderately deep to shallow, silty soils that are also well drained. In most places soils that are shallow over dolomite or sandstone occupy the bluffs, but there are some cliffs or outcrops of bedrock. Gently sloping to steep soils occupy the valley slopes. The soils of this association are dominantly deep, well drained, and silty, but some shallow or excessively drained, sandy soils are included. This association occupies about 30 percent of the county.

A large part of this association consists of Seaton and Dubuque soils (fig. 6). Seaton soils are on the less steep part of the ridgetops and on the valley slopes, and Dubuque soils are on the steeper parts of the ridgetops. Areas of Steep stony and rocky land lie between areas of these soils on the ridgetops and those on the valley slopes.

Minor soils on the ridges are the Otterholt, Renova, Whalan, and Spencer. Also, sizable areas of Downs soils occur on ridges in Hartland and Trenton Townships, and smaller areas of those soils are scattered throughout the association. Boone, Hixton, and Gale soils occupy a minor acreage on the valley slopes. Other minor soils are the

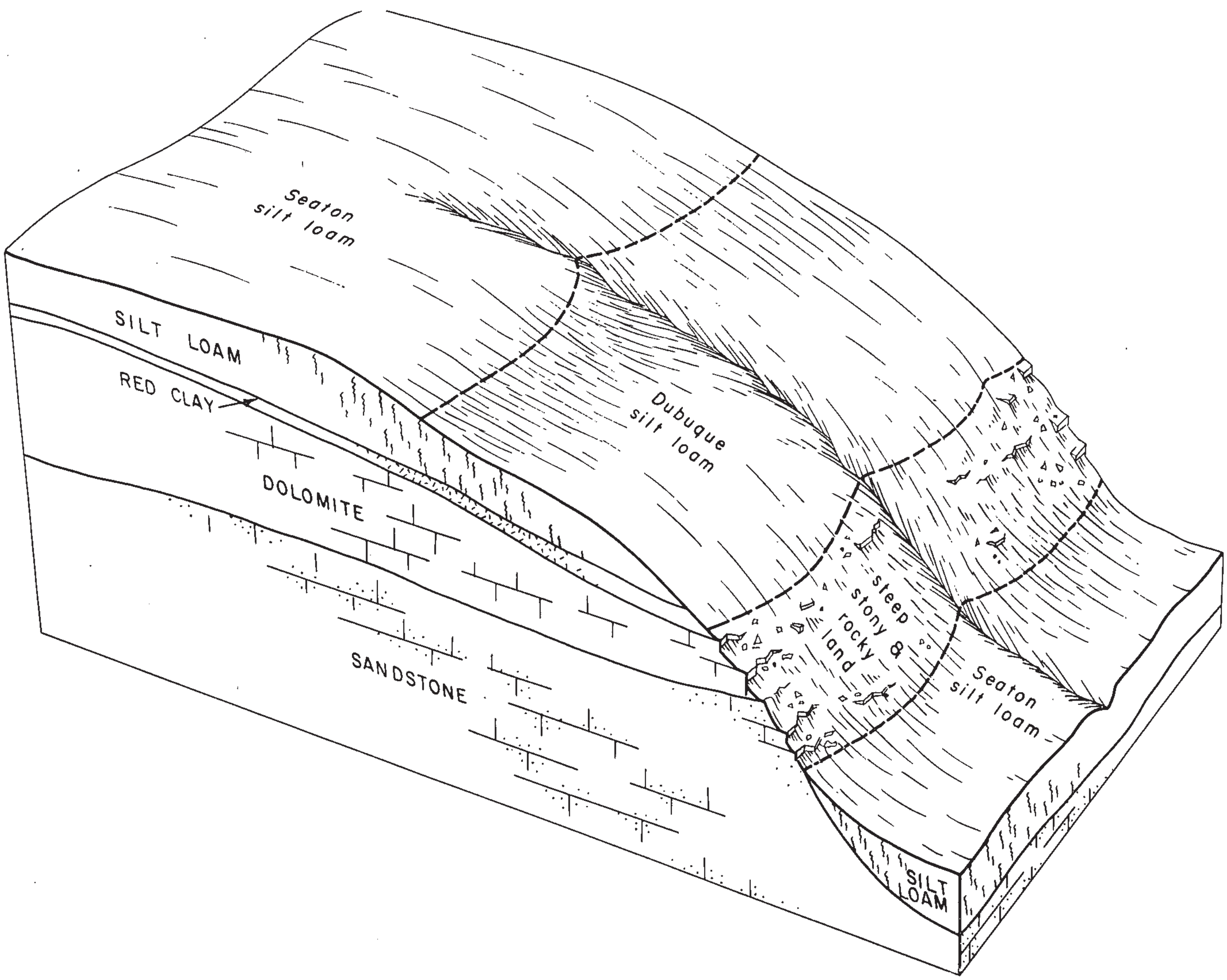

***Figure 6.*—Cross section of association 6 showing the topography, the major soils, and the underlying material.**

Fayette, Tell, Meridian, and Plainfield on stream terraces; Chaseburg and Worthen soils in upland drainageways; and areas of Alluvial land and Arenzville soils on the narrow bottoms of the coulees.

In this association the bluffs that face north and east are generally covered by a dense stand of timber. The timber is more sparse on the bluffs that face south and west, and the native grasses in those areas compete with the hardwoods for dominance. Some of these bluffs are used for pasture, but cattle generally do not obtain much forage. Where the deep, silty soils of the upland ridges and valley slopes are properly farmed, excellent crops of corn, oats, and hay are produced. The shallower Dubuque soils are less productive and are more adversely affected by erosion than the deeper soils.

Erosion is a serious hazard if areas of this association are cultivated. In many places runoff that flows down the face of the bluffs and down the valley slopes from Seaton and Dubuque soils on the ridges causes serious gully erosion and methods of safely disposing of this water are needed. Also, the pastures are subject to damage if they are overgrazed. The wooded areas are subject to damage if they are improperly managed.

Many of the farms in this soil association are two story, with part of the cropland on the ridgetops and part in the valleys. On those farms, management is complex because of the wide range in the kinds of soils, especially in the sloping and eroded phases.

7. Otterholt-Spencer Association

Deep, silty soils over till-capped dolomite

This soil association consists of gently rolling to steep upland ridges, very steep bluffs, gently sloping to steep valley slopes, narrow terraces, and bottom lands. It occupies about 20 percent of the county.

Physiographically, this association is similar to soil association 6. It differs in that a layer of glacial till overlies the dolomite and is generally within 5 feet of the surface. The layer of till caps the ridgetops, but it does not extend into the narrow, steep-walled valleys. From this till, the soils derive some of their characteristics.

Deep, silty, well drained and moderately well drained soils are on the ridgetops. Moderately deep to shallow, well-drained, silty soils are on the steeper side slopes of the ridges, next to the bluffs. The bluffs are occupied by soils that are very shallow over dolomite or sandstone. Some cliffs or outcrops of bedrock occupy a part of the association, but the cliffs are not so prominent a feature of the bluff areas as those in soil association 6. The soils of the valley slopes are silty, and they range from deep and well drained to shallow and excessively drained.

A major part of the association consists of Otterholt and Spencer soils (fig. 7). These deep, silty, well drained or moderately well drained soils occur with Renova soils on many of the broader ridgetops. Dubuque soils are on the steeper, narrow ridgetops and on the valley slopes. Seaton soils mainly occupy the valley slopes.

Whalan, Gale, and Hixton soils occupy a minor part of the association and are on the valley slopes. Other soils that make up minor acreages are the Fayette, Tell, Meridian, Stronghurst, and Onamia on stream terraces; Chaseburg and Orion soils in upland drainageways; areas of Alluvial land and Riverwash and of Arenzville and Orion soils in coulees and on the major stream bottoms; and areas of Steep stony and rocky land and Terrace escarpments in the bluff areas and on the terrace breaks. In addition, some poorly drained and somewhat poorly drained soils, such as the Almena, occur south of Olivet, within the upper limits of the watershed of Plum Creek. In the areas where those soils occur, there is a perched water table and seepage flows are common. Also, in the same general area, small, isolated patches of Santiago soils occupy the tops of the highest ridges.

The slopes of the bluffs that face north and east in this association are generally covered by a dense stand of timber. The timber is more sparse on the slopes of the bluffs that face south and west, and native grasses compete with the hardwood trees for dominance. Many of the south- and west-facing slopes are used for pasture, but yields are low.

Where the deep, silty soils of the upland ridges, valley slopes, and terraces are properly farmed, yields of corn, oats, and hay are generally good. The shallower Dubuque soils and the Whalan soils are less productive and are more adversely affected by erosion than are the deeper soils. Control of excess water is needed for reliable production of crops on the Almena, Sargeant, and Sable soils.

Erosion is a serious hazard in areas of this association that are cultivated. Excess water is a hazard in the somewhat poorly drained or poorly drained areas. The pastures are subject to damage if they are overgrazed, and the wooded areas are subject to damage if they are improperly managed. Methods are needed to safely dispose of the excess water on the valley slopes so that gullying will be prevented.

Many of the farms in this soil association are two story, with part of the cropland on the ridgetops and part in the valley. On those farms management is complex because of the wide range in the kinds of soils and slopes and the wide range in the degree of erosion.

8. Sparta-Plainfield Association

Deep, sandy soils of stream terraces

This soil association consists of terraces formed at several different levels by the Mississippi River. It is bordered on the south and west by the Mississippi River and its alluvial flood plain. On the north it is bordered by the bluffs of the upland. The association occupies most of the terrace between Hager City and Bay City. The soils of this association are nearly level to gently sloping and are sandy and loamy. They are underlain by loose, sandy and gravelly material. Dark-colored soils are predominant, but light-colored soils are also extensive. The association makes up about 2 percent of the total land area in the county.

A major part of this association consists of Sparta and Plainfield soils (see fig. 3). The Plainfield soils are less extensive than the Sparta. They are most extensive on the east end of the terrace, above Bay City. The Sparta and Plainfield soils are deep, excessively drained, and sandy, and they formed in outwash sand and gravel. They differ from one another in the thickness and color of their surface layers. The Sparta soils have formed

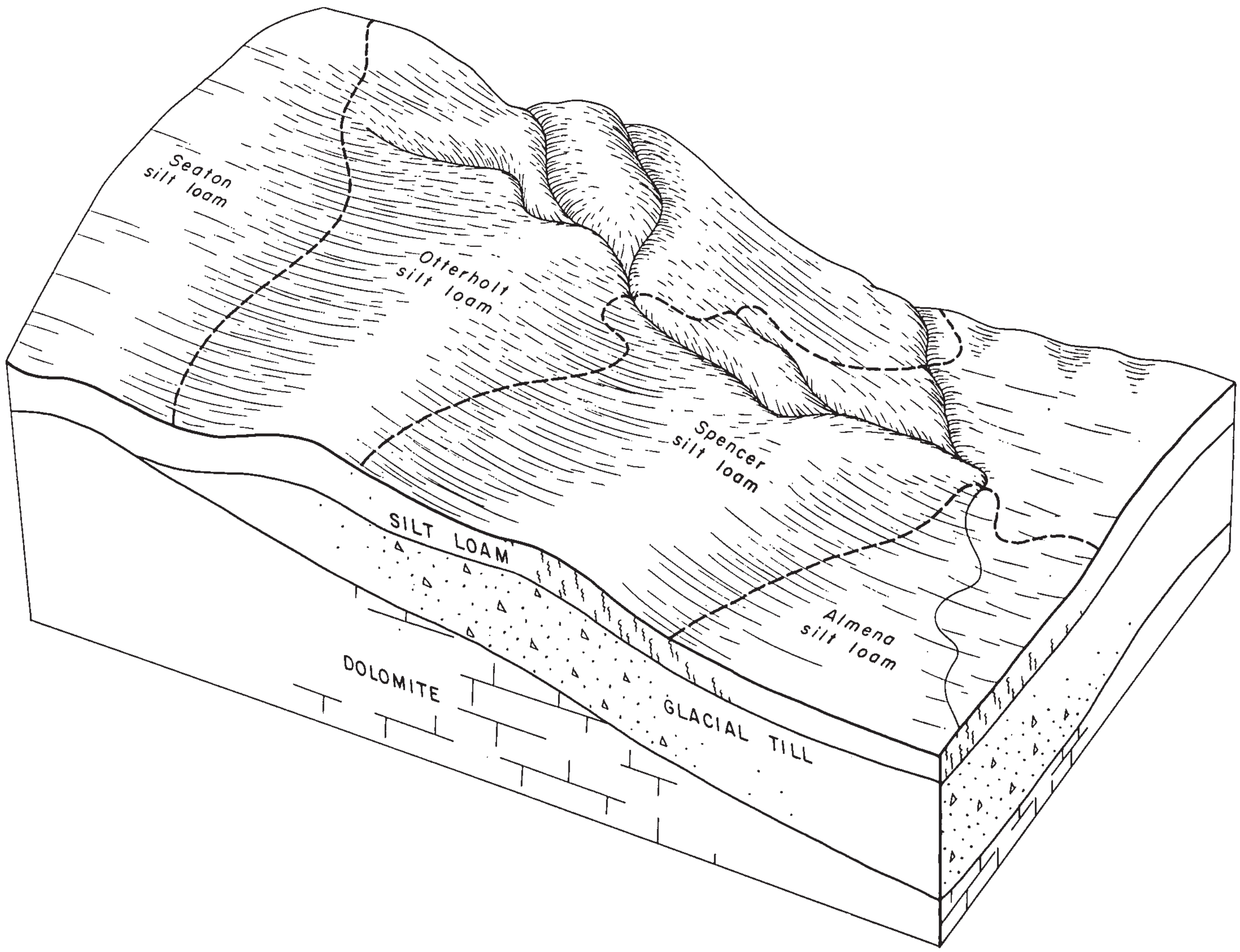

***Figure 7.*—Cross section of association 7 showing the topography, the major soils, and the underlying material.**

under a cover of prairie grasses, and they have a thick, dark-colored surface layer. The Plainfield soils have formed under forest. Their surface layer is lighter colored than that of the Sparta soils.

Minor soils of this association are the Burkhardt, Dakota, and Waukegan. Also, small areas of Onamia, Fayette, Antigo, and Port Byron soils occupy part of the terrace. Terrace escarpments form the steep breaks between the levels of the terrace. They also separate this soil association from the areas of Alluvial land of association 9 on bottom lands of the Mississippi River.

Except for small areas in woodlots, this association has all been cleared, and most of the acreage is used for crops. Some areas of the Plainfield soils have been planted to pines or are idle. Plantings of pines have also been established on some areas of Sparta soils. The Burkhardt, Dakota, and Waukegan soils are better suited to field crops than are the Plainfield and Sparta soils, and they are used mainly for that purpose.

This association is attractive to homebuilders, and several small residential areas have already been established. Attractive homesites, some that overlook the Mississippi River, are available on several levels of the terrace. The sandy and gravelly material that underlies the soils is excellent for the construction of small buildings and for systems for disposing of waste material. Also, this area is convenient to Red Wing, Minn., which is just across the river.

Management is difficult in this association because the soils are droughty and low in fertility. Also, the soils along the terrace escarpments are subject to gullying and to erosion by wind and water.

9. Arenzville-Alluvial Land Association

Soils of the bottom lands

This association consists of narrow, nearly level bottom lands along the major streams in the county. It also includes broader areas of the flood plain of the Mississippi River and small areas of soils on low stream terraces. The areas are bordered by steep bluffs or by terrace escarpments. The association occupies about 3 percent of the total land area in the county.

Areas of loamy Alluvial land occupy the largest acreage in the association. Soils of the Arenzville series are extensive (fig. 8), and the association also contains a considerable acreage of Orion soils. The soils formed in water-deposited material washed from the adjacent uplands. The largest area of Alluvial land, wet, is on the flood plain of the Mississippi River. Smaller areas are on the bottom lands of all the major streams in the county.

A minor part of the association is occupied by Terril soils and by areas of sandy Alluvial land and Riverwash. Riverwash consists of bars of sand and gravel and of the channels of dry streams.

All of the soils of this association are subject to flooding and to deposition of overwash. The Arenzville, Terril, and Orion soils are deep and are silty and loamy. If those soils are protected from flooding, excellent yields of corn, oats, and hay are obtained. The areas of Alluvial land, loamy, vary in texture and depth and are less productive than the deep, silty soils. Alluvial land, wet, is mainly in trees and is maintained largely as areas for wildlife and recreation. Alluvial land, sandy, is suitable only for pasture or for wildlife and recreational areas. Riverwash is unproductive of plants.

The soils of this association are subject to flooding during the growing season, and they receive deposits of unwanted material carried by the floodwaters. They are also subject to streambank erosion and to channel cutting. The coarse-textured soils, furthermore, are droughty and low in fertility, and some of the areas are inaccessible because they are cut by channels and sloughs.

10. Santiago-Wykoff Association

Moderately deep to shallow, silty soils underlain by reddish-brown, acid till

This soil association consists of several small, isolated areas of soils on ridgetops within areas of soil association 5. The physiographic features are similar to those of association 5, but the slopes are more gentle. The areas form a discontinuous pattern at the highest elevation on the landscape. Most of them are centrally located on the broadest ridges. The association occupies about 1 percent of the total land area in the county.

Santiago and Wykoff soils are dominant in this association (fig. 9). They formed in a mantle of moderately deep, silty or loamy material over reddish-brown sandy loam till. The till overlies yellowish-brown till that is typical in this part of the county. Minor soils of the association that also formed over the reddish-brown till are the moderately well drained Freeon and the somewhat poorly drained Freer. Those soils are on gentle concave slopes of small watersheds.

Other minor soils in the association are the Otterholt soils and Renova and Vlasaty soils, which occur together. The Otterholt soils occur where the mantle of silty material is thick. The Renova and Vlasaty soils generally occur at a slightly lower elevation in the soil pattern than do the other soils.

All of the soils of this association are well suited to general farming and are easily managed. Most of the

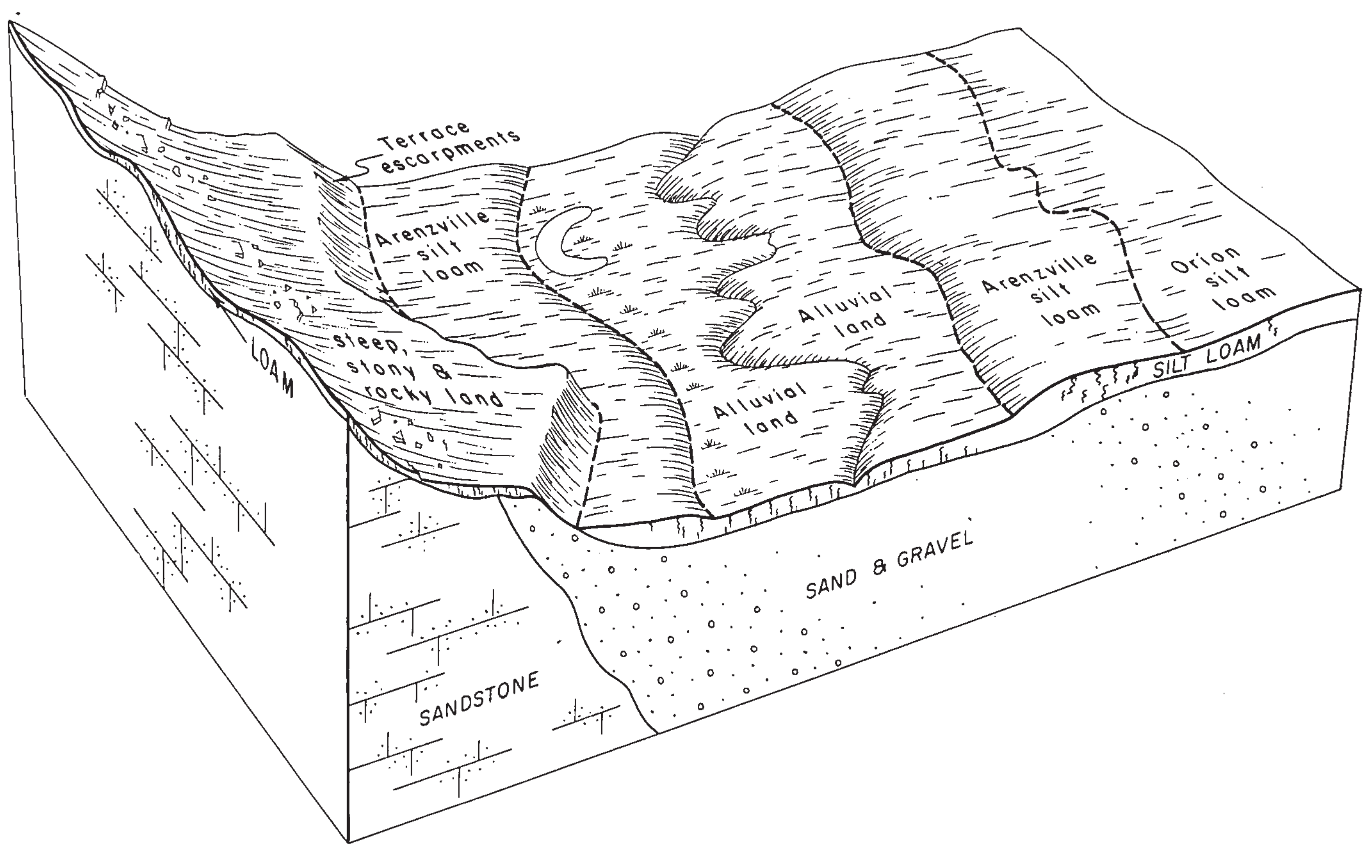

***Figure 8.*—Cross section of association 9 showing the topography, the major soils, and the underlying material.**

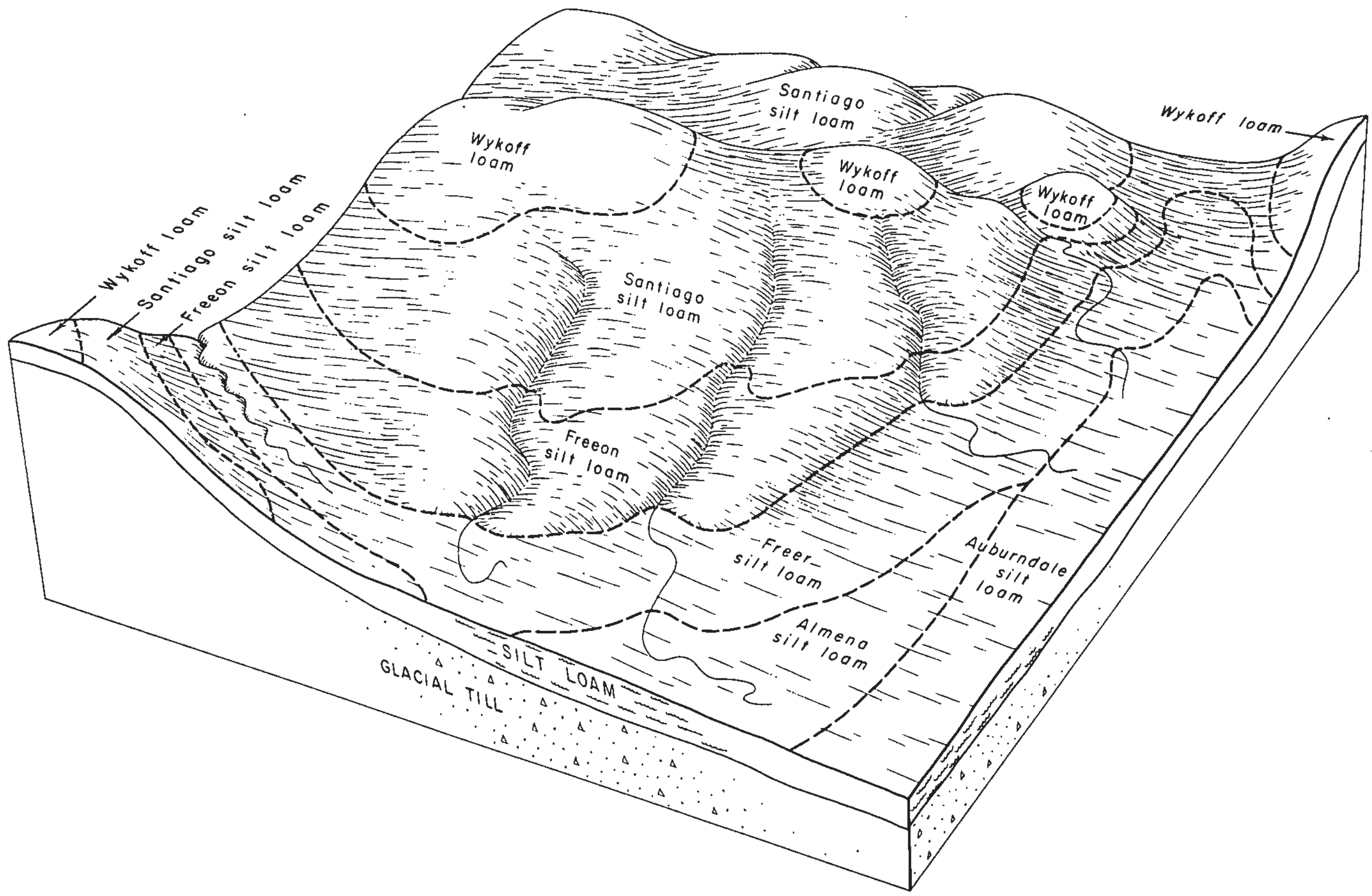

***Figure 9.*—Cross section of association 10 showing the topography, the major soils, and the underlying material.**

acreage is used for crops, but some areas are wooded. Where good management is used, yields of corn, oats, and hay are generally good. In cultivated areas the soils are subject to serious erosion, and methods of safely disposing of excess water are needed on the steeper side slopes. Also, the pastures are subject to damage if they are overgrazed. The wooded areas are subject to damage if they are not properly managed.

Use and Management of Soils

This section has several main parts. The first explains the system of capability classification used by the Soil Conservation Service, and the next describes management of groups of soils, the capability units. Then, predicted annual yields per acre of the principal crops are shown. Finally, information about managing the soils as woodland and for engineering is given.

Capability Groups of Soils

Capability classification is the grouping of soils to show, in a general way, their suitability for most kinds of farming. It is a practical classification based on limitations of the soils, the risk of damage when they are used, and the way they respond to treatment. The soils are classified according to degree and kind of permanent limitation, but without consideration of major and generally expensive landforming that would change the slope, depth, or other characteristics of the soils; and without consideration of possible but unlikely major reclamation projects.

In the capability system, all kinds of soils are grouped at three levels, the capability class, subclass, and unit. These are discussed in the following paragraphs.

Capability Classes, the broadest grouping, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. Classes are defined as follows:

Class I. Soils have few limitations that restrict their use.

Class II. Soils have some limitations that reduce the choice of plants or require moderate conservation practices.

Class III. Soils have severe limitations that reduce the choice of plants, or require special conservation practices, or both.

Class IV. Soils have very severe limitations that restrict the choice of plants, require very careful management, or both.

Class V. Soils subject to little or no erosion but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife food and cover.

Class VI. Soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife food and cover.

Class VII. Soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to grazing, woodland, or wildlife.

Class VIII. Soils and landforms have limitations that preclude their use for commercial plant production and restrict their use to recreation, wildlife, water supply, or esthetic purposes.

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in some parts of the United States but not in Pierce County, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only subclasses indicated by *w*, *s*, and *c*, because the soils in it are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-2 or IIIe-1. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation, and the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph. The Arabic numeral specifically identifies the capability unit within each subclass.

In the following pages, the capability units in Pierce County are described and suggestions for the use and management of the soils are given. Where the need for lime and fertilizer is indicated in the suggestions for management, the amount of lime and the kinds and amounts of fertilizer to apply should be determined by soil tests. The capability units are not numbered consecutively, because not all of the capability units used in Wisconsin are in this county. To find the names of the soils in any given unit, refer to the "Guide to Mapping Units" at the back of this soil survey.

CAPABILITY UNIT I-1

In this capability unit are nearly level, moderately well drained or well drained, deep soils that are silty or loamy. These soils are on broad ridgetops, stream terraces, and glacial till plains. They have a subsoil in which permeability is moderately slow or moderate, and they generally have moderate or high available moisture capacity.

The Fayette, Dakota, and Rozetta soils of this unit are on stream terraces. During thaws in spring or during severe storms, they receive water that runs off the adjacent uplands. Normally, the water does not stand on the surface for long periods, and crops may benefit from this extra moisture. The Rozetta and Spencer soils are moderately well drained. In some places those soils warm up somewhat more slowly in spring than the other soils. The Chaseburg and Worthen soils are subject to occasional overflow. All of the soils of this unit are easy to work. They have few limitations and can be cultivated safely if ordinary farming methods are used.

Where crop residue is removed from the field, a suitable cropping system is 2 years of row crops, 1 year of a small grain, and 2 years of hay. If the crop residue is left on the surface or plowed under, however, and if fertility is kept high and minimum tillage is practiced, row crops can be grown year after year.

If fertility is kept high, these soils can be used intensively for corn, small grains, forage crops, and special crops, such as peas, potatoes, and green beans. They can also be used for pasture and trees, or to provide food and cover for wildlife.

If lime is applied, the stands of legumes grown on these soils last longer and the yields of crops, especially of alfalfa and clover, generally increase. Where corn, peas, or similar row crops are grown frequently, barnyard manure, a crop grown as green manure, and crop residue help to maintain favorable soil structure. Keeping tillage to a minimum helps to prevent compaction of the soils where row crops are grown successively for several years. Insects and plant diseases are more difficult to control if the same crop is grown on these soils for several years in succession.

CAPABILITY UNIT IIe-1

This capability unit consists of deep or moderately deep, well drained and moderately well drained loams and silt loams. These soils are gently sloping and are on uplands, valley slopes, and stream terraces. They have moderate or moderately slow permeability and have moderate to high available moisture capacity. Some of these soils are moderately eroded, and additional erosion is a slight hazard.

The Dubuque soils of this unit are slightly shallower than the other soils. Therefore, yields of crops grown on the Dubuque soils are likely to be slightly lower, especially in dry years, than yields of crops grown on the other soils. Yields on the Port Byron soil, on the other hand, are generally slightly higher than yields on the other soils. The Freeon, Rozetta, and Spencer soils are moderately well drained and are generally slower to dry out and warm up in spring than the other soils.

The soils of this unit are well suited to all of the crops commonly grown in the county. Row crops can be grown for several years in succession if all of the crop residue is left on the field in winter and is turned under in spring. Where row crops are grown, contour stripcropping or terracing is needed to control erosion in the more sloping areas. Using the wheel-track method for planting corn, and also shredding crop residue, will help to pro-

tect the soils. Where no special practices are used to control erosion, a suitable cropping system is 1 year of a row crop, 1 year of a small grain, and 3 years of hay.

Except where the soils of this unit have been recently limed, good response is received from applications of lime. Good response is also received from applications of fertilizer. The content of organic matter, needed especially in the moderately eroded soils, can be increased by adding a large amount of manure.

CAPABILITY UNIT IIe-2

This capability unit consists of deep and moderately deep, well-drained soils that are underlain by outwash sand, gravel, or bedrock. These soils are slightly droughty because most of them have only fair to moderate available moisture capacity. They are moderately permeable and are easy to cultivate.

The soils of this unit are gently sloping and are slightly susceptible to erosion. Such practices as contour stripcropping and terracing help to control erosion and conserve moisture.

These soils are well suited to corn, small grains, grasses, and legumes. They can also be used to provide pasture for livestock, as woodland, or for areas that provide food and cover for wildlife. Where no special practices are used to control erosion, a suitable cropping system is 1 year of a row crop, 1 year of a small grain, and 3 years of hay.

Lime is needed on all of these soils unless lime has been added recently. Crops grown on the moderately eroded areas benefit if organic matter is returned to the soils. Organic matter can be returned by adding a large amount of manure and using a cropping system that consists largely of legumes and grasses.

CAPABILITY UNIT IIe-5

The only soil in this capability unit is Chaseburg silt loam, 2 to 6 percent slopes. This is a deep, well drained or moderately well drained soil that formed in silty local alluvium. It is moderately permeable and has high available moisture capacity. This soil is in narrow drainageways and on the lower slopes of valleys. It is subject to occasional overflow, and detrimental overwash is deposited when the areas are flooded. Erosion is a slight hazard. Except for some channel cutting and gullying, however, this soil is not subject to serious damage from erosion. If control of overflow is needed, dikes, constructed grass waterways, or diversions can be used to provide protection.

This soil is suited to all of the crops grown in the county, and most of the areas are cultivated. The gentle slopes and high natural fertility make this soil suitable for intensive cropping. Where no special practices are needed to control erosion, a suitable cropping system consists of 1 year of a row crop, 1 year of a small grain, and 3 years of hay.

Originally, the soil reaction was neutral. Therefore, little or no lime is needed unless this soil has been cropped intensively for many years.

CAPABILITY UNIT IIe-7

This capability unit consists of deep, well-drained, gently sloping fine sandy loams of uplands, valley slopes, and outwash plains. In places these soils are underlain by loamy material. In other places the underlying material is sandy but contains bands of loamy material. Permeability is moderately rapid in the upper part of the profile and moderate in the lower part. The available moisture capacity is moderate to high.

The finer texture of the underlying material gives these soils somewhat higher available moisture capacity than is normal for fine sandy loams. Crops may be damaged by drought, however, during extended dry periods. Most of these soils are already eroded to some extent, and they are subject to further erosion by wind and water. Practices that conserve moisture and that control erosion are necessary. Practices that increase the supply of plant nutrients and that maintain the content of organic matter are also needed.

Where no special practices are used to control erosion, a suitable cropping system is 1 year of a row crop, 1 year of a small grain, and 3 years of hay. Although terraces are difficult to build and maintain on these soils, a suitable cropping system where terraces can be built is 2 years of row crops, 1 year of a small grain, and 1 year of hay.

Wind erosion can be controlled by keeping a cover of growing plants or crop residue on the surface at all times. Liberal use of barnyard manure and of green manure helps to return organic matter needed to improve tilth.

Crops that are grown the most commonly on these soils are corn, small grains, soybeans, grasses, and legumes. These soils can also be used for pasture, trees, or wildlife habitats.

CAPABILITY UNIT IIs-1

The soils of this capability unit are moderately deep, well-drained, nearly level loams and silt loams of stream terraces and outwash plains. These soils are underlain by loose sand or gravel. They have fair or moderate available moisture capacity and are moderately permeable.

The soils of this unit are easy to maintain and work if the content of organic matter is kept high. They are slightly droughty during extended dry periods. Management practices that conserve water will be beneficial to crops, especially during dry periods. These soils may be cropped intensively if good soil structure and favorable permeability are maintained.

These soils are well suited to all of the crops grown in the area. They are moderately to highly productive if they are well managed, and if the supply of plant nutrients is kept high. Most of the soils are well suited to use as pasture, woodland, or wildlife areas as well as being suitable for field crops. A suitable cropping system consists of 2 years of row crops, 1 year of a small grain, and 2 years of hay. Row crops can be grown year after year if the soils are irrigated and are well managed.

Adding liberal applications of barnyard manure and green manure regularly helps to maintain the content of organic matter needed to improve tilth. It also helps to conserve moisture.

CAPABILITY UNIT IIw-1

The soils of this capability unit are deep, somewhat poorly drained and poorly drained silt loams that are nearly level. These soils are in shallow depressions and

in drainageways in the uplands. Wetness is caused by the slow surface drainage and slow internal drainage, by the accumulation of runoff from adjacent areas, and by seepage.

These soils dry out and warm up more slowly in spring than do well-drained soils. After rains of long duration, they remain wet longer than do the adjacent better drained areas. Surface drainage is needed in the nearly level areas and depressions to speed up the removal of accumulated water. Dikes, diversions, or waterways should be constructed to prevent frequent ponding caused by runoff from the adjacent uplands. These soils can be tile drained if suitable outlets are available. Dependable yields are not obtained, unless some drainage is provided.

If these soils are adequately drained, a suitable cropping system is one in which a row crop is grown for 1 year and is followed by 1 year of a small grain with a catch crop. Row crops can be grown year after year if the content of organic matter and the supply of plant nutrients are kept high, if minimum tillage is practiced, and if good tilth and favorable soil structure are maintained. The areas that are not adequately drained can be used for pasture or meadow.

Lime is not needed, but crops grown on these soils respond well to applications of fertilizer. For most crop plants, the root zone is restricted to the upper part of the subsoil. Alfalfa and other crops that have roots long enough to penetrate into the slowly permeable underlying material can improve the internal drainage.

CAPABILITY UNIT IIw-2

The soils of this capability unit are deep, somewhat poorly drained silt loams that are nearly level or gently sloping. The Sargeant soils of the unit are in shallow depressions and in drainageways in the uplands. The Stronghurst soil is on low stream terraces. These soils have high available moisture capacity and moderate to slow permeability. In a few places, they are wet as a result of seepage, but mainly they are wet because of the slow surface drainage, slow internal drainage, and accumulation of runoff from adjacent areas. Dependable yields are not obtained unless some drainage is provided.

These soils dry out and warm up more slowly in spring than do well-drained soils. Also, after rains of long duration, they remain wet longer than the better drained soils in adjacent areas. Water erosion is a slight hazard in the gently sloping areas. Surface drainage is needed in places to speed the removal of surface water in the nearly level places or in depressions. Because runoff from adjacent slopes occasionally ponds on these soils, dikes, diversions, and waterways are needed in some areas. These soils are generally suitable for surface drainage, and they are suitable for tile drainage if outlets are available. The tile drains should be made of acid-resistant concrete or clay, because these soils have a medium acid to very strongly acid subsoil and underlying material.

Diversions may be used to reduce the length of the slopes and to remove the excess surface water. Tile drains are more effective where favorable soil structure is maintained than where the structure has deteriorated. Where the structure is favorable, the excess water enters the soil and moves down to the tile. Adding a liberal amount of organic matter regularly and working the soils only when they are dry enough that puddling does not occur will help to maintain favorable soil structure.

The soils of this unit are well suited to corn, small grains, grasses, and legumes. Alsike clover and ladino clover are better suited than alfalfa if good drainage cannot be established. These soils are also suitable for use as pasture, woodland, and wildlife areas.

Where surface water can be controlled and adequate drainage established, a suitable cropping system for these soils consists of 2 years of row crops, 1 year of a small grain, and 1 year of hay. Row crops can be grown year after year if a high content of organic matter and a good supply of plant nutrients are maintained, if minimum tillage is practiced, and if good tilth and favorable soil structure can be preserved. Where no special practices are used to control erosion, a suitable cropping system consists of 1 year of a row crop, 1 year of a small grain, and 2 years of hay.

Generally, lime is needed. Because these soils warm up rather slowly in spring, a starter fertilizer that contains nitrogen assures rapid initial growth of crops. The depth of root penetration is not restricted for most crops.

CAPABILITY UNIT IIw-3

Only one soil, Schapville silt loam, wet subsoil variant, 2 to 6 percent slopes, eroded, is in this capability unit. This is a moderately deep, somewhat poorly drained, nearly level or gently sloping soil of the uplands. It is underlain by shale bedrock. Permeability is moderately slow, and the available moisture capacity is high. Runoff and seepage are received from the adjacent areas.

This soil dries out and warms up more slowly in spring than do well-drained soils. In places surface drainage is needed to speed up the removal of the surface water in nearly level areas or in depressions. In some places diversions and waterways are also needed to intercept the runoff from adjacent areas. Where it is feasible to use drainage practices that are designed to control seepage in the sloping areas, those practices should be applied. Generally, the limited depth to shale bedrock makes this soil unsuitable for tile drainage.

This soil is well suited to corn, small grains, grasses, and alfalfa or other legumes. Where good drainage cannot be established, alsike clover and ladino clover can be grown instead of alfalfa. This soil is also well suited to use as woodland or for wildlife areas. Where drainage is adequate, a suitable cropping system is 1 year of a row crop, 1 year of a small grain, and 2 years of hay.

Good response is generally received from applications of lime and fertilizer on this soil. A starter fertilizer that contains nitrogen assures the rapid initial growth of crops. Returning crop residue to the soil, adding a liberal amount of barnyard manure, and working this soil only when it is dry enough to prevent puddling will help to maintain good soil structure.

CAPABILITY UNIT IIw-4

This capability unit consists of deep, somewhat poorly drained silt loams. These soils have a tight subsoil that restricts the movement of water. They are in depressions, on concave slopes around drainageways, and in a few seep spots in the uplands. Permeability is moderately slow, and the available moisture capacity is high. Wetness

is caused primarily by slow surface drainage and a slowly permeable subsoil. Dependable yields are not obtained unless some drainage is provided.

These soils dry out and warm up more slowly in spring than do well-drained soils. In places drainage is needed in the nearly level areas or in depressions to speed up the removal of the surface water. Runoff from the adjacent slopes occasionally ponds on the surface. Therefore, dikes, diversions, and waterways are needed to protect the soils. Generally, the tight subsoil and the restricted movement of water make these soils unsuitable for tile drainage. Erosion is a slight hazard in the gently sloping areas.

Diversions may be used to reduce the distance that water travels down the slopes, and they help to remove the excess surface water. Returning crop residue to the soils, adding a liberal amount of barnyard manure, and working the soils only when they are dry help to maintain good soil structure. Drainage of the subsoil can be improved by growing sweetclover or other deep-rooted plants that open root channels through the soil material. Where good drainage cannot be established, alsike clover and ladino clover can be grown instead of alfalfa.

These soils are well suited to corn, small grains, grasses, and alfalfa or other legumes. Alsike clover and ladino clover can be grown instead of alfalfa if good drainage cannot be established. The soils are also well suited to use as woodland or areas for wildlife. Where adequate surface drainage is provided and no special practices are used to control erosion, a suitable cropping system consists of 1 year of a row crop, 1 year of a small grain, and 2 years of hay.

Lime is generally needed if these soils are used for field crops. Because these soils are somewhat slow to warm up in spring, a fertilizer containing nitrogen assures the rapid initial growth of crops. The depth of root penetration is not restricted for most crops.

CAPABILITY UNIT IIw-5

The soils of this capability unit are moderately deep, somewhat poorly drained loams and silt loams that are underlain by sand or gravel. These soils are nearly level or gently sloping and are in shallow depressions on stream terraces. They have high available moisture capacity and moderate or moderately slow permeability. The slow surface drainage and a high water table that results from a slowly permeable layer in the underlying material make these soils wet. Unless some drainage is provided, the growth of crops is restricted.

The soils of this unit dry out and warm up more slowly in spring than do well-drained soils. Unless drainage is provided, the soils are wet for long periods, but they are dry in summer. The gently sloping areas are also slightly susceptible to erosion. Open ditches can be used to provide drainage. Diversions can be used to intercept runoff from the adjacent areas and to reduce the length of the slopes.

These soils are well suited to corn, small grains, grasses, and alfalfa or other legumes. In the areas that have not been drained, alsike and ladino clover can be grown instead of alfalfa. The soils are also suited to use as woodland or wildlife areas.

If these soils are adequately drained, they can be used intensively for crops. Where adequate drainage is provided, a suitable cropping system consists of 2 years of row crops, 1 year of a small grain, and 1 or 2 years of hay. Row crops can be grown year after year if the content of organic matter and the supply of plant nutrients are kept high. Also, minimum tillage must be practiced so that favorable soil structure will be maintained. Where adequate drainage is not provided, these soils can be used for forage crops and small grains.

If contour stripcropping is practiced, a suitable cropping system for the gently sloping areas is 2 years of row crops, 1 year of a small grain, and 2 years of hay. If no special practices are used to control erosion in the gently sloping areas, a suitable cropping system consists of 1 year of a row crop, 1 year of a small grain, and 3 years of hay.

CAPABILITY UNIT IIw-11

This capability unit consists of deep, moderately well drained or well drained soils on flood plains or in small drainageways. These soils are subject to overflow, especially during spring thaws and heavy rains. They have high available moisture capacity and are moderately permeable. In most places, however, crops may be damaged by occasional flooding.

If these soils are adequately protected from flooding and from deposition of undesirable material, they are well suited to corn, small grains, grasses, and legumes. They are also suited to potatoes, peas, and other special crops.

Because of the ease of farming and the high natural fertility, most areas of these soils are intensively cropped. Row crops can be grown year after year if protection is provided from flooding, if minimum tillage is practiced, and if favorable soil structure, a good supply of plant nutrients, and a high content of organic matter are maintained.

Dikes can be used in some areas to protect these soils from damage caused by stream overflow. Constructing terraces and practicing stripcropping on the slopes above will help to keep undesirable material from washing onto them. The areas that are frequently flooded, or that are inaccessible to farm machinery, can be used for pasture, as woodland, or for wildlife areas.

Where lime has not been added, these soils have nearly neutral reaction. Therefore, little or no lime is required.

CAPABILITY UNIT IIw-13

Orion silt loam is the only soil in this capability unit. It is deep, somewhat poorly drained, and nearly level, and it formed in silty alluvium on flood plains or in small drainageways. The available moisture capacity is high, and this soil is moderately permeable. In most places, however, crops may be damaged by occasional flooding. Wetness is caused by a high water table, poor surface drainage, or seepage.

If this soil is adequately protected from flooding and from deposition of undesirable material, it is suited to corn, small grains, grasses, and legumes. Crop yields can be improved by using open ditches to provide drainage. Dikes can be used in some places to give protection from overflow. Constructing terraces and practicing stripcropping on the slopes above will help to keep undesirable material from washing onto this soil. The areas that are frequently flooded, or that are inaccessible to farm

machinery, can be used for pasture, as woodland, or for wildlife areas.

Where this soil is protected from flooding and is adequately drained, a suitable cropping system is 2 years of row crops, 1 year of a small grain, and 2 years of hay. Row crops can be grown year after year, but crop residue must be returned to the soil. Also, a good supply of plant nutrients and organic matter should be added regularly, minimum tillage should be practiced, good tilth must be preserved, and the soil must be protected from overflow. The areas that are not drained and protected from flooding can be used to grow forage crops, as woodland, or for wildlife areas.

If lime has not been added, this soil has nearly neutral reaction, and little or no lime is needed. Response is generally good, however, where lime and fertilizer are applied.

CAPABILITY UNIT IIIe-1

The soils of this capability unit are deep or moderately deep, moderately well drained or well drained loams and silt loams. These soils are gently sloping or sloping, and they occur on uplands, valley slopes, and stream terraces. In most places these soils are moderately eroded. The available moisture capacity is moderate to high, and permeability is moderate or moderately slow.

These soils are well suited to all of the crops commonly grown in the county. Yields are generally good if the supply of plant nutrients is kept high, and if the soils are well managed. Further erosion is a moderate hazard. Such practices as contour stripcropping and terracing are needed to protect the soils and to conserve water.

If row crops are grown successively for several years, all of the crop residue should be left on the field over winter and turned under in spring. Where no special erosion control practices are used, a suitable cropping system is 1 year of a small grain and 2 years of hay. The Dubuque soils of this unit are slightly shallower than the other soils. On those soils crop yields may be slightly lower than on the other soils, especially in dry years.

The soils of this unit are acid, except where they have recently been limed. Barnyard manure and supplemental applications of nitrogen are needed for high yields of corn. Regular additions of organic matter, needed on eroded soils, can be obtained by adding a large amount of manure, or by growing grasses and legumes for a large part of the time in the cropping system.

CAPABILITY UNIT IIIe-2

The soils of this capability unit are moderately deep, well-drained loams and silt loams that are underlain by sand, gravel, or bedrock. These soils are gently sloping or sloping, and they occur on uplands, stream terraces, and outwash plains. Their available moisture capacity is fair to moderate, and permeability is moderately rapid or moderate. These soils are slightly droughty during extended dry periods. Some of them are eroded.

Practices that control erosion are needed on these soils. Erosion can be controlled by practicing contour stripcropping, terracing, or contour farming; applying adequate fertilizer; and properly managing crop residue.

These soils are well suited to all of the crops commonly grown in the county. Except for the Dakota soil, they are also well suited to pasture, to trees, and to use as wildlife areas. The Dakota soil has formed under prairie and is not well suited to trees. A cropping system in which alternate strips are kept in meadow provides the most effective control of erosion. Where no special erosion control practices are used, a suitable cropping system is 1 year of a small grain followed by 2 years of hay.

Unless lime has recently been applied, lime is needed on all of these soils. The content of organic matter may be low if a suitable cropping system has not been used, and if all the crop residue has not been returned to the soils. Regular additions of large amounts of manure and use of a cropping system in which legumes and grasses are grown a larger part of the time than indicated in the preceding paragraph will improve soil tilth.

CAPABILITY UNIT IIIe-3

The soils of this capability unit are gently sloping, well drained or moderately well drained silt loams that are underlain by dolomite or shale. These soils are subject to slight or moderate erosion, and some of them are already moderately eroded. They are somewhat droughty because their available moisture capacity is low or fair. Permeability is moderately slow in the Derinda soils, and it is slow in the underlying shale bedrock. Permeability is moderate in the upper part of the Dunbarton profile, and it is slow in the clayey material weathered from dolomite. The soils of this unit warm up somewhat slowly in spring.

Practices that control erosion and that conserve water are needed for these soils; further erosion would make the soils even more droughty. These soils are moderately shallow over bedrock or clayey material. Therefore, terraces are generally not practical. Stripcropping may be difficult in places because of the outcrops of bedrock. Contour stripcropping or farming on the contour can provide the needed erosion control if the soils are fertilized properly, and if the crop residue is properly managed.

These soils are suited to corn, small grains, and legumes and grasses for hay or permanent pasture. They are also suited to use as woodland or wildlife areas. Where no special practices are used to control erosion, a suitable cropping system is 1 year of a small grain and 3 years of hay.

Unless lime has recently been applied, it is needed on all of these soils. The content of organic matter may be low if a suitable cropping system has not been used, and if all the crop residue has not been returned to the soils. Tilth may be improved by adding a large amount of manure and using a cropping system in which legumes and grasses are grown a larger part of the time than indicated in the cropping system described in the preceding paragraph.

CAPABILITY UNIT IIIe-4

The soils of this capability unit are well-drained, gently sloping sandy loams that are shallow to moderately deep over loose sand or gravel. These soils are on stream terraces. They are subject to slight to moderate erosion by wind and water. The available moisture capacity is fair or low, and permeability is moderately rapid or rapid. Consequently, these soils are droughty. Crops

grown on them are likely to be damaged by lack of moisture during dry periods. The Dakota and Onamia soils are moderately deep, and the Burkhardt and Chetek soils are shallow over coarse-textured material.

Management practices are needed that conserve moisture and that protect these soils from erosion. Keeping the surface rough, or leaving crop residue on the surface as a mulch, protects the soils from wind erosion and reduces losses from erosion. Organic matter can be added by applying barnyard manure and turning under crop residue and green manure. Practicing wind stripcropping and planting shelterbelts in suitable places will help to protect the soils from damage by wind. Contour stripcropping helps to control both wind and water erosion.

In many places terraces are difficult to build and maintain on these sandy soils. Where level terraces are feasible to build, they can be used to reduce the length of the slopes.

These soils are easily tilled, and nearly all areas are cultivated. Corn, small grains, grasses, and soybeans or other legumes are the principal crops. Smaller acreages are in permanent pasture and trees. These soils have only limited suitability for trees, but they are well suited to use for wildlife areas.

Where no special practices are used to control erosion, a suitable cropping system consists of 1 year of a small grain and 3 years of hay. Crops grown on these soils respond well to irrigation, especially during periods of low rainfall. If wind erosion is controlled, and if the content of organic matter is kept high, the irrigated areas can be used fairly intensively for cultivated crops. Response is moderately good to applications of lime and fertilizer.

CAPABILITY UNIT IIIe-7

The soils of this capability unit are moderately deep, sloping, well-drained to somewhat excessively drained fine sandy loams and very fine sandy loams. They are on uplands, valley slopes, and outwash plains. The available moisture capacity is moderate or high, and permeability is moderate or moderately rapid. The Renova soil is underlain by loam glacial till. The Hesch, Hixton, and Lamont soils have a loamy layer within the sandy underlying material.

The soils of this unit are moderately susceptible to erosion by wind and water, and most of the areas are already eroded. In addition, the soils are droughty, especially during periods when the amount of rainfall is low or when rainfall is poorly distributed. Management practices are needed that conserve moisture and that also protect the soils from erosion. Keeping the surface layer rough or leaving crop residue on the surface as a mulch protects these soils from wind erosion and reduces losses of moisture. Organic matter can be added by turning under crop residue and green manure and by adding barnyard manure. Planting shelterbelts helps to protect the soils from erosion by wind, and contour stripcropping gives protection from erosion both by wind and water.

Terraces are difficult to build and maintain on these moderately coarse textured soils. During periods of low rainfall, the crops that are grown respond to irrigation. If these soils are irrigated, a larger amount of fertilizer is needed than if they are not irrigated. If the soils are protected from erosion, and if organic matter is added regularly, the irrigated areas can be used more intensively than is feasible otherwise.

These soils are easily tilled, and nearly all of the acreage is cultivated. The principal crops are corn, small grains, grasses, and soybeans and other legumes. A few areas are used for permanent pasture, as woodland, or to provide cover for wildlife. The Renova soil is better suited to trees than the other soils of the unit.

Where the length of the slopes is about 200 feet, and where no special practices are used to control erosion, a suitable cropping system is 1 year of a small grain and 3 years of hay. A less intensive cropping system should be used if the slopes are longer than 200 feet, and a more intensive cropping system may be used if the slopes are shorter than 200 feet.

Natural fertility is moderately low, and crops grown on these soils do not respond as well to applications of lime and fertilizer as do crops grown on finer textured soils. Organic matter can be added by applying a large amount of barnyard manure, turning under green manure, and using a cropping system in which legumes and grasses are grown more of the time than suggested in the cropping system described in the preceding paragraph.

CAPABILITY UNIT IIIe-8

Deep, somewhat poorly drained, sloping silt loams that have slow internal drainage are in this capability unit. These soils occupy concave slopes around upland drainageways. A few of the areas are in seep spots. The available moisture capacity is high, and permeability is moderately slow. These soils are moderately susceptible to erosion. Also they are wet, generally because they receive runoff from adjacent areas. Protection is needed from erosion, and disposal of the excess water is needed for good, dependable yields. Although additional surface drainage may be needed, diversions can be used to intercept runoff and dispose of it safely through waterways. Also, tile drains made of acid-resistant concrete or clay are suitable.

These soils are suited to corn, small grains, grasses, and legumes, but yields are rather low. Where good drainage cannot be established, alsike or ladino clover can be grown instead of alfalfa. These soils are also suited to pasture, or they can be used as woodland or for wildlife areas. Where no special practices are used to control erosion, a suitable cropping system is 1 year of a small grain and 2 years of hay.

Crops grown on these soils generally need lime. Because these soils are somewhat slow to warm up in spring, a starter fertilizer that contains nitrogen assures rapid early growth of crops. Adding a liberal amount of organic matter, and working the soils only when they are dry, will help to maintain good soil structure.

CAPABILITY UNIT IIIs-2

This capability unit consists of somewhat excessively drained and well-drained, nearly level loams and sandy loams. The Burkhardt soils are shallow, and the Dakota soil is moderately deep over loose sand or gravel. These soils are on stream terraces and outwash plains. They have low available moisture capacity and rapid or moderately rapid permeability. Consequently, they are

droughty. In dry years crops grown on them are likely to be damaged by lack of moisture. Wind erosion is also a hazard.

Management practices are needed that conserve moisture and that protect these soils from wind erosion. Keeping the surface rough, or leaving crop residue on the surface as a mulch, will give protection from wind erosion and reduce losses of moisture. Organic matter can be added by turning under crop residue and green manure and by applying barnyard manure. Practicing wind stripcropping and planting shelterbelts in suitable places will help to protect the soils from damage by wind. Crops grown on these soils respond well to irrigation, especially during periods of low rainfall.

These soils are suited to all of the crops grown in this area. They are better suited to crops that tolerate dry weather, however, than to crops that require a large amount of moisture. The soils are only fairly well suited to trees, but they are suited to pasture and to use as wildlife areas.

Where no practices are used that conserve moisture and control wind erosion, a suitable cropping system is 1 year of a row crop, 1 year of a small grain, and 2 years of hay. Row crops may be grown year after year, however, if the supply of plant nutrients is kept high, if organic matter is added regularly, if minimum tillage is practiced, and if wind erosion is controlled. Row crops may also be grown year after year if the soils are irrigated, if the crop residue is properly managed, and if the soils are protected by a cover crop in winter or at other times when they would otherwise be bare.

The soils of this unit have moderately low natural fertility. Therefore, fertilizer is needed for good yields. Less response is obtained from applications of lime and fertilizer than is obtained on finer textured soils. Generally, the amounts of lime and fertilizer applied are smaller than are applied on finer textured soils.

CAPABILITY UNIT IIIs-8

The only soil in this capability unit is Derinda silt loam, 0 to 2 percent slopes. This soil is well drained or moderately well drained, and it is underlain by shale bedrock at a depth of 1 to 2 feet. Because of the bedrock near the surface, the available moisture capacity is fair. Practices that conserve moisture are important in managing this soil.

This soil is suited to all of the crops normally grown in the area, but it is better suited to crops that tolerate dry weather than to other crops. It is easily tilled, and nearly all of the acreage is in crops. This soil is also well suited to pasture and to use for wildlife areas, but it has limited suitability for trees.

Where no special practices are used to control erosion, a suitable cropping system is 1 year of a small grain and 2 years of hay. If all of the crop residue is returned, if a good supply of plant nutrients is maintained, and if minimum tillage is practiced, a row crop, a small grain, and hay can be grown for 1 year each.

Crops grown on this soil respond well to applications of lime and fertilizer. Organic matter can be added by turning under crop residue and green manure and by adding barnyard manure. The rate of water infiltration can be increased if tillage is kept to a minimum, and if good soil structure is maintained. Where this soil is tilled, the surface can be left rough to decrease the amount of moisture lost through evaporation.

CAPABILITY UNIT IIIw-3

Auburndale silt loam is the only soil in this capability unit. It is a deep, poorly drained, nearly level soil of upland drainageways, and it has moderately slow permeability in the subsoil. Wetness is caused by the slow surface drainage and slow internal drainage, by the water from adjacent areas that accumulates, and by seepage. Water is removed so slowly that the soil remains wet for a large part of the time. Dependable yields of crops are not obtained unless some drainage is provided.

This soil dries out and warms up more slowly in spring than do well-drained soils. In the nearly level areas and in the areas in depressions, surface drainage is needed to speed up the removal of accumulated water. This soil can be protected from runoff by constructing dikes, diversions, or waterways. It is not suited to tile drainage.

Where adequate drainage is provided, a suitable cropping system is 1 year of a row crop, 1 year of a small grain, and 2 years of hay. Where no drainage is provided, this soil can be used for meadow, pasture, trees, or wildlife areas. The areas used for meadow or pasture need to be renovated and topdressed. Management practices suitable for woodland are discussed in the section "Woodland Uses of the Soils."

This soil has naturally low fertility and is slightly acid to very strongly acid. Large applications of fertilizer and lime are needed for optimum yields. For most crop plants, the root zone is restricted to the upper part of the subsoil.

CAPABILITY UNIT IIIw-12

This capability unit consists of areas of nearly level or gently sloping, moderately deep, loamy Alluvial lands that are on flood plains and are subject to frequent overflow. In most places the water table is at a depth of about 5 feet or less. Some of the areas are inaccessible because they are isolated by stream channels or sloughs, and those areas are subject to streambank cutting. The available moisture capacity and permeability are moderate. Erosion is a slight hazard in the gently sloping areas. Random surface drains may be needed to remove the excess water from the depressions.

If these land types are protected from overflow, they are suited to corn, small grains, grasses, and legumes, and they can also be used for potatoes, peas, and other special crops. Where overflow is not a serious hazard, row crops can be safely grown 1 year out of 4. Where tillage is kept to a minimum and the content of organic matter and the supply of plant nutrients are kept high, row crops can be grown year after year if flooding is not a severe hazard during the cropping season. If frequent flooding is a hazard, these land types can be used to grow forage crops.

In the areas used to produce forage, wild hay can be replaced by tame hay. The wooded areas should be maintained by protecting them from fire and grazing. The areas used as habitats for wildlife can be improved by preserving the trees and shrubs that provide food and cover.

CAPABILITY UNIT IVe-1

The soils of this capability unit are deep or moderately deep, well-drained loams and silt loams that are moderately steep. These soils are on uplands and valley slopes. They have moderate to high available moisture capacity and moderate or moderately slow permeability. Because of the rapid runoff, all of these soils are subject to severe erosion. Some of them are already moderately or severely eroded.

If these soils are well managed, they are suited to corn, small grains, grasses, and legumes. Careful management is required, however, if cultivated crops are grown. These soils are also suitable for use as woodland or for wildlife areas, but trees grow better on the light-colored than on the dark-colored soils. Where no special practices are used to control erosion, a suitable cropping system is 1 year of a small grain and 3 years of hay. Contour stripcropping is needed, however, to control erosion in the areas used for crops. Grassed waterways safely carry runoff to a natural drainageway.

Moderately good response is obtained from applications of lime and fertilizer. Where legumes are grown, adequate lime is needed for optimum yields. In addition to erosion control practices, adding barnyard manure and plowing down green manure crops and crop residue are especially beneficial in maintaining the present moderate to high available moisture capacity of these soils.

CAPABILITY UNIT IVe-2

The soils of this capability unit are moderately deep, well-drained loams and silt loams that are underlain by sand, gravel, or limestone bedrock. These soils are moderately steep, and they occur on uplands and outwash plains. Most of these soils have moderate permeability and fair or moderate available moisture capacity. The Wykoff soils, however, have moderately rapid permeability, and the Onamia soil has moderate to moderately low available moisture capacity. Some of the soils are already moderately or severely eroded, and the rapid runoff makes all of the soils subject to severe erosion. Droughtiness is a slight hazard.

Practices that control erosion are needed. Contour stripcropping and the use of diversions to reduce the length of the slopes are effective practices for controlling erosion, and they also conserve moisture. Adequate fertilization and good management of crop residue are desirable for improving the tilth of the surface layer, especially in the severely eroded places. The subsoil is exposed in the severely eroded Wykoff soil of this unit. The present surface layer of this severely eroded soil is lower in content of organic matter than those of the soils that are not severely eroded. The Wykoff soil is also harder to till than the other soils.

The soils of this unit are well suited to small grains and forage crops. They are also well suited to use as woodland or pasture, and they can be used for wildlife areas. Where no special practices are used to control erosion, these soils ought to be kept in grass. Periodic renovation helps to maintain the pastures. Any additional losses of surface soil through erosion would seriously reduce the effective depth of the soils and would reduce the available moisture capacity. Therefore, the soils that are not protected need to be kept in hay or in rotation pasture most of the time.

Moderately good response is obtained from applications of lime and fertilizer. Adequate lime is needed for optimum yields of legumes.

CAPABILITY UNIT IVe-3

The soils of this capability unit are well-drained, sloping loams and silt loams that are moderately shallow over bedrock. They are on uplands and on rock-formed terraces. These soils are moderately susceptible to erosion, and some areas where erosion is already severe are included in the unit. In addition, the available moisture capacity is fair or moderate and the soils are droughty. The Derinda and Schapville soils are underlain by shale bedrock that is somewhat less permeable than the thinly layered siltstone and sandstone underlying the thin solum variant of the Gale series. The Dunbarton and Rockton soils are underlain by limestone.

Terraces are difficult to construct on these moderately shallow soils. In places stripcropping is difficult because of the outcrops of bedrock. Further erosion would make these soils even more shallow and more droughty.

The soils of this unit are suited to small grains, legumes, hay, and permanent pasture. Also, the soils have limited suitability for trees, and row crops can be grown, to some extent, if the soils are carefully managed.

In areas where erosion has been the most active, the supply of plant nutrients and the content of organic matter are low. In those areas good tilth is hard to maintain. Such areas can be used for row crops, however, if practices are applied to control erosion. Where the slopes are about 200 feet long and no special practices are used to control erosion, a suitable cropping system is 1 year of a small grain and 3 years of hay. Where the slopes are shorter, or where severely eroded spots occur in less sloping areas, a more intensive cropping system can be used. If the slopes are very long, the cropping system should be less intensive.

Good response is obtained from applications of lime and fertilizer. Where the acid subsoil variant of the Derinda series is very shallow over extremely acid shale, the surface layer of that soil is very acid. In those areas large applications of lime are needed.

CAPABILITY UNIT IVe-4

The soils of this capability unit are well-drained, moderately deep sandy loams or fine sandy loams on outwash plains and on low, rolling sandstone uplands. The Onamia soil is underlain by loose sand and gravel. The Hixton soil is underlain by weathered sandstone. These soils have fair available moisture capacity and moderate or moderately rapid permeability. They are already moderately eroded and are moderately susceptible to further erosion by water and slightly susceptible to further erosion by wind. They are also somewhat droughty.

Terraces are difficult to construct and maintain on these sandy soils. Stripcropping provides protection from erosion by wind and water, and it also conserves water. Leaving the surface rough, or leaving crop residue on the surface as a mulch, gives protection from wind erosion and also reduces losses of moisture. Organic matter can

be added by turning under crop residue and green manure and by applying barnyard manure.

These soils are easily tilled, and most of the areas are cultivated. The soils are suited to small grains, legumes, hay, and plants suitable for permanent pasture. Row crops can be grown, to a limited extent, if the soils are carefully managed. The soils are only fairly well suited to trees.

Where no special practices are used to control erosion, a suitable cropping system is 1 year of a small grain and 3 years of hay. Some areas can be irrigated and used fairly intensively for cultivated crops if wind erosion is controlled, and if the content of organic matter is kept high. Response to applications of lime and fertilizer is moderate.

CAPABILITY UNIT IVe–7

The soils of this capability unit are moderately deep, well-drained or somewhat excessively drained fine sandy loams or very fine sandy loams. They are moderately steep and are on uplands, valley slopes, and outwash plains. The available moisture capacity is fair to moderate, and permeability is moderate to moderately rapid. These soils are droughty and are subject to severe erosion by water and wind. Most of them are already eroded. The sandy variant of the Renova series is underlain by loam glacial till and is slightly less droughty than the other soils of this unit.

Management practices that protect these soils from erosion and that conserve water are needed. Keeping the surface rough or leaving crop residue on the surface as a mulch provides protection from wind erosion and reduces losses of moisture. Organic matter can be added by turning under crop residue and green manure and by applying barnyard manure.

Terraces are difficult to construct and maintain on these sandy soils. Stripcropping provides protection against erosion by wind and water, and it also conserves water.

These soils are easily tilled, and most of the areas are cultivated. The soils are suited to small grains and to legumes and other plants suitable for hay or permanent pasture. They are also suitable for wildlife areas, but they have limited suitability for trees.

If wind erosion is controlled, and if the content of organic matter is kept high, areas of these soils that are irrigated can be used fairly intensively for cultivated crops. Where no special practices are used to control erosion, the soils are better used for pasture than for crops that require cultivation. Periodic renovation helps to maintain a good cover in the pastured areas. Response to lime and fertilizer is moderate.

CAPABILITY UNIT IVs–3

The soils of this capability unit are excessively drained, nearly level or gently sloping loamy sands, loamy fine sands, and loams that are mainly moderately deep or deep. These soils are on uplands, stream terraces, and outwash plains. They have low available moisture capacity, very rapid permeability, and low natural fertility. The soils are droughty, and they are highly susceptible to wind erosion. The Boone soil is underlain by weathered sandstone, and sandstone bedrock is within 3 feet of the surface in some places.

The soils of this unit are highly susceptible to wind erosion. The sloping areas are highly susceptible to gully erosion if the soils are not protected from runoff from adjacent areas. Gullies, once started, enlarge rapidly, and they are extremely difficult to control.

If these soils are used for field crops, they need to be protected from wind erosion by such practices as use of shelterbelts (fig. 10) and wind stripcropping. These practices also protect the surface soil from warm, drying winds in summer. In the sloping areas, contour stripcropping is beneficial for controlling erosion both by wind and water. Applying barnyard manure, turning under green manure, and returning crop residue to the soils are practices that are especially valuable. They not only protect the surface from the action by wind, but they also supply plant nutrients and help to maintain favorable available moisture capacity.

These soils are suited to corn, soybeans, small grains, and hay, and they can also be used for pasture. They are not used extensively for permanent pasture, however, and yields of forage are generally low. These soils can be used for wildlife areas, and the idle or low-producing areas are suitable for plantings of coniferous trees (fig. 11).

If these soils are properly managed, a suitable cropping system is 2 years of row crops, 1 year of a small grain, and 1 year of hay. If this cropping system is used, the soils need to be protected by a cover crop, crop residue should be properly managed, wind stripcropping or shelterbelts should be used, and the supply of plant nutrients and the content of organic matter must be kept high. Row crops can be grown year after year if the soils are irrigated and protected by windbreaks or a cover crop, and if the crop residue is properly managed.

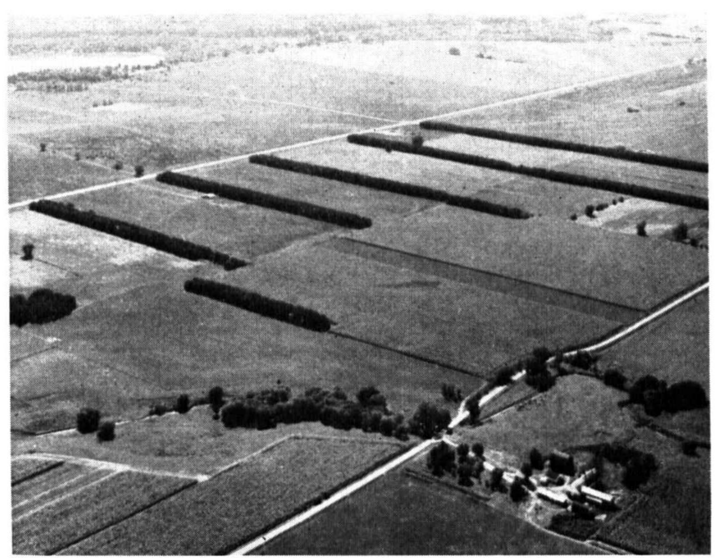

***Figure 10.*—Areas of Plainfield and Sparta soils that are protected by shelterbelts. Lack of fine-textured binding material in the surface layer leaves these soils highly susceptible to wind erosion. Shelterbelts of evergreen trees have proved to be effective in protecting the soils from erosion by wind.**

Figure 11.—**A plantation of Norway pines on Sparta soils.**

Where no practices are used to control wind erosion, these soils can be used for small grains and for hay and pasture. If the soils are used to grow forage crops, adding a topdressing of fertilizer annually and renovating the pastures or meadows at least once in 5 years will help to maintain favorable yields and a good cover of plants. In the pastures, careful management is needed to prevent damage from overgrazing.

Response to applications of lime and fertilizer is moderate on these soils. Some of the soils are deficient in boron. Therefore, a fertilizer that contains some boron, but that consists largely of potash, is especially beneficial if legume-grass hay crops are grown. Regular applications of lime are needed for legumes grown for hay.

CAPABILITY UNIT IVw-7

Adrian muck is the only soil in this capability unit. It is a poorly drained, nearly level organic soil that is underlain by sand at a depth of 12 to 30 inches. This soil is on bottoms of the South Fork of the Kinnickinnic River. It has high available moisture capacity and moderately rapid permeability. The water table is within 3 feet of the surface.

This soil can be drained by open ditches. After it is drained, it is susceptible to subsidence and erosion by wind. The subsidence can be reduced by controlling the level of the water table. Wind strips, shelterbelts, or cover crops are needed to control wind erosion if this soil is drained and cultivated. Row crops can be grown year after year if such practices are applied.

The areas that have not been drained are suitable for meadow and pasture, or they can be used as areas for wildlife. Tame hay is more suitable than wild grass if this soil is used to grow forage crops. Reed canarygrass forms a tough, dense sod that supports light haying equipment or grazing cattle. Periodic topdressing with fertilizer improves the quality of the grass and makes the grass more palatable.

The areas that have not been drained provide excellent habitats for waterfowl. They can be improved by level ditching or by installing structures for controlling the level of the water.

This soil is low in phosphorus and potassium. Crops grown on it respond favorably to large applications of commercial fertilizer. The soil warms up slowly in spring. Therefore, a starter fertilizer that contains nitrogen is needed for the rapid early growth of crops.

CAPABILITY UNIT Vw-14

Only Alluvial land, wet, is in this capability unit. It is a deep, poorly drained miscellaneous land type that has a high water table and is subject to severe flooding. This land type is mainly on the flood plain of the Mississippi River and on bottoms of the larger tributary streams. It has high available moisture capacity and moderate natural fertility. In many places sloughs or the channels of streams make the areas inaccessible.

Protecting this land type from overflow, or installing drainage so that tilled crops can be grown, is generally not feasible. Therefore, this land type is not suited to cultivation. Most of the areas are suitable for pasture, trees, or use for wildlife. The native pastures consist largely of grasses of low quality.

In some places dikes or embankments can be constructed to protect this land type from flooding. The areas so protected are suitable for meadow. The yields of forage can be increased by establishing a stand of tame hay and by fertilizing and renovating the meadows and pastures.

This land type can be improved for wildlife habitats by establishing plantings that provide food and cover. Dikes or ditches can be used to control the water and to improve the areas for waterfowl and fur-bearing animals.

CAPABILITY UNIT VIe-1

The soils of this capability unit are deep or moderately deep, well-drained silt loams that are steep or moderately steep. They are on silt-capped uplands, on valley slopes, and on severely eroded glacial uplands. The soils have moderate or high available moisture capacity and moderate or moderately slow permeability. Some of the areas are already moderately eroded or severely eroded. The steep areas of slightly or moderately eroded soils are subject to very severe water erosion. The hazard of further erosion is severe on the moderately steep soils that are already severely eroded.

The soils of this capability unit occupy a fairly large acreage, and they are used to produce a large part of the forage grown in the county. The soils are suitable for meadow or pasture, or they can be used for woodland or for wildlife habitats. A good cover of sod can be maintained by controlling grazing and renovating the pastures once every 5 years. Topdressing with a suitable fertilizer each year can be substituted for renovation.

The large wooded areas of these soils will yield greater returns than pasture if the trees are protected from fire and from grazing by livestock. In addition, the soils provide good habitats for wildlife.

CAPABILITY UNIT VIe-2

The soils of this capability unit are moderately deep, well-drained loams and silt loams that are underlain by sandstone, gravel, or limestone bedrock. They are steep or moderately steep, and they occur on the uplands. The available moisture capacity is moderate, and these soils are slightly droughty during extended dry periods. The Whalan soils are underlain by a thin layer of glacial till over limestone bedrock, and they are less droughty than the Wykoff soil.

The soils of this unit can be used for meadow, pasture, and trees, or they can be used to provide food and cover

for wildlife. They are not suited to cultivated crops. Renovating the pastures at least once every 5 years helps to maintain a good cover of plants. Topdressing with fertilizer each year may be substituted for renovation. Controlling grazing in the pastured areas helps to maintain a good cover of sod, and it protects the soils from erosion. Gullies, once formed, are hard to control. If they are not controlled, they are likely to advance into areas of adjacent cropland.

Steep, slightly eroded and moderately eroded areas of these soils are susceptible to additional very severe erosion. The moderately steep, severely eroded areas are susceptible to severe erosion. The surface layer of the severely eroded soils is in poor tilth. The rate of infiltration is slower than that of uneroded soils. As a result, more water runs off and the soils become more droughty. Large applications of barnyard manure and commercial fertilizer are needed to improve the structure, to increase the rate of infiltration, and to make tilth more favorable.

Areas of these soils that are now in trees yield greater returns than pasture if they are protected from fire and grazing. Protecting the soils from fire and grazing also greatly improves the areas for wildlife habitats.

CAPABILITY UNIT VIe-3

The soils of this capability unit are moderately steep, well drained or moderately well drained loams and silt loams that are underlain by bedrock. They are on uplands and terrace breaks.

These soils are subject to severe erosion, and some areas where erosion is already severe are included in this unit. Available moisture capacity is fair or moderate. Runoff is rapid because of the moderately steep slopes. These soils are more droughty than similar less sloping soils. The Derinda and Schapville soils are underlain by shale bedrock. Their underlying material has slower permeability than the siltstone and sandstone underlying the Gale thin solum variants. The Dunbarton and Rockton soils are underlain by dolomitic limestone.

The soils of this unit are not suited to cultivated crops, but they can be used for such permanent vegetation as meadow or pasture. They can also be used for trees to a limited extent. The small areas where outcrops of bedrock are common can be used to provide cover for wildlife.

Controlling grazing and renovating the pastures once in 5 years will help to maintain a good cover of sod on these soils. Topdressing with fertilizer each year can be substituted for renovation. Large applications of manure and fertilizer are needed in the severely eroded areas to obtain a satisfactory seeding of forage crops and to improve the structure and tilth of the surface soil.

In most places crops grown on these soils show moderate response to applications of lime and fertilizer. The acid variant of the Derinda series is underlain by extremely acid shale, and it too is acid. Where shale is near the surface of this soil, the surface layer is so acid that the growth is inhibited of some crops that are otherwise suitable. Large applications of lime are needed for good yields on these acid areas, but adding lime may not be economically feasible.

Areas of these soils that are now in trees yield greater returns than areas in pasture if the soils are protected from fire and grazing. The areas can also be greatly improved for wildlife habitats by allowing small trees and shrubs to grow up.

CAPABILITY UNIT VIe-4

The soils of this capability unit are well-drained, moderately steep sandy loams or fine sandy loams that are moderately deep to moderately shallow. They are on hilly outwash plains and on sandstone uplands. The Chetek soil is underlain by loose outwash sand. The Hixton soil is underlain by material weathered from sandstone.

These soils have fair or low available moisture capacity and moderate or rapid permeability. They are already moderately eroded, and the hazard of further erosion is severe. Gullying is a hazard if the soils are not protected. Once gullies develop, they enlarge rapidly and are extremely difficult to control. More water runs off these soils than runs off less sloping soils. As a result, the soils are more droughty than similar soils that are less sloping.

The soils of this unit are not suited to cultivated crops. They can be used for permanent vegetation, however, such as meadow, pasture, or trees, and they can be used as habitats for wildlife. Where these soils are used for meadow or pasture, controlling grazing and renovating the areas once in 5 years will help to maintain a good cover of sod and give protection from gullying. Topdressing with fertilizer each year can be substituted for renovation.

Moderately high yields of forage can be obtained on these soils if a legume-grass mixture is seeded, and if enough lime and fertilizer are applied. Natural fertility is moderately low. The supply of plant nutrients can be increased by adding barnyard manure.

Wooded areas of these soils can be profitably maintained in trees if the areas are protected from fire and grazing. Trees that are planted in bare areas need protection from wind erosion. Such protection can be provided by windbreaks or by maintaining a protective cover until the trees are well established. The soils are better suited to pines than to hardwoods.

CAPABILITY UNIT VIe-7

Only Hixton fine sandy loam, loamy substratum, 20 to 30 percent slopes, is in this capability unit. This is a moderately deep, somewhat excessively drained soil on valley slopes in the northwestern part of the county.

This soil has low to moderate available moisture capacity and moderate permeability. In areas that are cleared, the hazard of erosion from wind and water is very severe. Most of the acreage is wooded, however, and therefore is protected from erosion. More water runs off this soil than runs off gently sloping soils. As a result, this soil is more droughty than less sloping soils. Natural fertility is moderately low.

In the areas now in meadow or pasture, a good cover can be kept on this soil by controlling grazing and renovating no oftener than once in 5 years. Topdressing with fertilizer each year can be substituted for renovation. The steep slopes may limit the number of areas where forage can be harvested. Nevertheless, moderate yields of forage can be obtained if a legume-grass mix-

ture is seeded, and if enough lime and fertilizer are applied. Barnyard manure can be added to increase the supply of plant nutrients.

Wooded areas of this soil need protection from fire and grazing. Young trees and shrubs can regenerate naturally in protected areas, and a good supply of food and cover is produced for wildlife. The soil is better suited to plantations of pines than to hardwoods. The small amount of erosion that has taken place helps to make this soil highly suitable for the planting of trees.

CAPABILITY UNIT VIs-3

The soils of this capability unit are excessively drained, sloping, moderately deep or deep loamy sands or loamy fine sands. They are on uplands, stream terraces, and outwash plains. Available moisture capacity is very low, permeability is very rapid, and natural fertility is very low. These soils are droughty and are susceptible to severe erosion caused by wind and water. Sandstone bedrock underlies the Boone soil; it is within 3 feet of the surface in some places.

The soils of this unit are not suited to cultivated crops. They can be kept in such permanent vegetation as meadow, pasture, or trees, and they can be used to provide habitats for wildlife. Renovating the pastures no oftener than once in 5 years is beneficial. Topdressing with fertilizer each year may be substituted for renovation. Control of grazing helps to maintain a good sod and protects the soils from gullying.

These soils are not used extensively for permanent pasture. Abandoned fields, formerly used for crops but now idle because of low productivity, are suitable for planting trees. The soils are better suited to pines than to hardwoods.

CAPABILITY UNIT VIs-5

This capability unit consists of thin, gravelly soils that are underlain by gravelly glacial drift. The soils are sloping to moderately steep and are on hilly uplands. They have low or moderate available moisture capacity and moderate or rapid permeability. These soils are very droughty. They are susceptible to moderate or severe erosion, and most of the areas are already eroded. A good cover of plants is difficult to maintain.

These soils can be used for meadow, pasture, or trees, and they are suitable for providing habitats for wildlife. Where the areas are used to produce forage, controlled grazing and renovation once every 5 years will help to maintain a good cover of sod. Topdressing with fertilizer each year can be substituted for renovation. The moderately steep areas are suitable for only limited grazing and production of forage.

The wooded areas need protection from fire and grazing. Such protection allows trees and shrubs to regenerate naturally, and it is favorable for providing food and cover for wildlife. Low-producing pastures or meadows, especially those in steep areas, give greater long-range returns if they are planted to pines.

CAPABILITY UNIT VIIe-1

The soils of this capability unit are moderately deep or deep, well drained, and loamy or silty. The Dubuque soil is very steep. It is on uplands and is underlain by limestone bedrock. Terrace escarpments, loamy, is moderately steep to very steep and is on breaks and ravines of stream terraces. The areas are underlain in places by loose sand or by limestone bedrock. The available moisture capacity is moderate, and runoff is very rapid on the steep slopes. Infiltration of water is slow. These soils are somewhat droughty, especially where the slopes face south or west.

The soils of this unit are well suited to trees and to use for providing habitats for wildlife. If the wooded areas are well managed, good economic returns can be realized from them. Also, little water runs off wooded areas. Where the soils are kept in trees, minimum damage from overwash and flooding occurs in the valleys below.

Fencing the wooded areas and protecting them from grazing will allow the natural restocking of young trees, and it allows the underbrush to make a dense growth. As a result, the areas are greatly improved for wildlife habitats.

Where these soils have not been disturbed, native hardwoods may be planted. Eroded sites and sites that were formerly cultivated but that have been abandoned for cultivation are suitable for planting pine trees. Plantations of pines stabilize the raw edges of the terraces. They conserve water by reducing runoff, in addition to providing merchantable timber products.

CAPABILITY UNIT VIIe-3

The soils of this capability unit are moderately well drained and well drained and are moderately steep or steep. They are underlain by bedrock and are on sandstone hills and on uplands capped by limestone. The available moisture capacity is low, and the hazard of further erosion is very severe. Runoff is very rapid, and little water infiltrates. These soils are droughty, especially where their slopes face south and west.

The soils of this unit can be used for such permanent vegetation as trees, and they can also be used to provide food and cover for wildlife. In most places they are in permanent pasture or are wooded. The wooded areas need protection from fire and grazing, and this protection also improves the areas for wildlife habitats. Open areas where outcrops are common can be planted to pines or maintained for wildlife habitats.

CAPABILITY UNIT VIIs-5

The soils of this capability unit are thin and gravelly, and they are underlain by coarse-textured, gravelly glacial till. The soils are on moraines and on gravelly knobs of glacial till plains. The available moisture capacity is low, and permeability is rapid. These soils are very droughty, and the hazard of water erosion is severe. A good cover of plants is difficult to maintain.

These soils are suitable for use as woodland and as habitats for wildlife. They can also be used for pasture. Yields are low, however, and a good sod is difficult to maintain, especially in the severely eroded spots. The wooded areas need protection from fire and grazing. Such protection allows young trees and shrubs to regenerate naturally, and it makes the areas more suitable for wild-

life. Areas that are not now in trees are suitable for the planting of pines.

CAPABILITY UNIT VIIs-9

This capability unit consists of very droughty soils that are subject to severe erosion. Most of the soils are too steep for cultivation, but Alluvial land, sandy, is nearly level. It is subject to flooding and is too low in fertility to be used for field crops.

The soils of this unit are suitable for use as woodland or for habitats for wildlife. The open areas are suitable for planting pines. Alluvial land, sandy, can be used for pasture to a limited extent, but it is subject to streambank erosion.

CAPABILITY UNIT VIIIs-10

Riverwash, the only mapping unit in this capability unit, consists of infertile soil material recently deposited by streams. In most places it occurs as sandbars in active streams or occupies the dry beds of intermittent streams. Because this land type is very droughty, subject to frequent flooding and deposition, and infertile, little or no useful vegetation is produced. The areas are used only for wildlife or for recreational purposes.

Predicted Yields

Table 1 gives predicted long-term average yields per acre for each soil or miscellaneous land type in the county. The columns marked "Average" give yields to be expected under the kind of management most farmers were practicing at the time this soil survey was made. Those marked "High" give yields to be expected under the kind of management practiced by many of the farmers in the county. Future improvement in the varieties planted and in the methods of culture could increase the yields shown.

For corn grown under average management, about 12,000 plants of hybrid corn per acre are planted and about 8 tons of barnyard manure and about 100 pounds of commercial fertilizer are applied as a starter. The seedbed is prepared in the usual manner. For oats or for seedlings of alfalfa-brome grown under average management, about 100 to 200 pounds of a fertilizer high in content of phosphorus and potassium is generally applied. Only a minimum of lime is added, and no special practices are used in preparing the seedbed or in cultivating the soils. Hay is cut twice each year, and the field is grazed in fall.

The management used to obtain the yields in the columns marked "High" is better than that used to obtain average yields. For corn, it includes (1) having the soils tested, (2) adding a large amount of manure, (3) applying commercial fertilizer according to the needs of the crop to be grown, (4) adding lime in the amounts indicated by the results of soil tests, (5) growing from 12,000 to 20,000 plants per acre, the greatest number of plants being grown on the best soils and the least number being grown on the less desirable soils, and (6) seeding, spraying, and cultivating at the right time.

For oats, the level of management needed for obtaining the yields given in the columns marked "High" consists of planting good seed of a variety suited to the soil, and of applying large amounts of phosphate and potash. For alfalfa, especially alfalfa grown in long rotations, it includes (1) adding lime according to the needs indicated by the results of soil tests, (2) planting varieties that are suited to the soil and that are resistant to wilt and to winterkill, (3) cutting at the right time so that two and sometimes three crops can be harvested during an average growing season, (4) allowing little or no grazing in fall, and (5) topdressing each fall with manure or a commercial fertilizer that is high in content of potassium and phosphorus and that also contains borax. Where a suitable cropping system is used, and where supplementary good management is practiced, high yields can be expected.

For pasture, the same general management principles apply that apply to field crops. For the yields in the columns marked "Average," farmers reseed their pastures infrequently or not at all and use only minimum amounts of lime and fertilizer. The "High" level of management includes (1) using lime and the proper kinds of fertilizer in the amounts indicated by the results of soil tests, (2) reseeding with suitable grasses and legumes, principally alfalfa-brome, (3) preparing the seedbed carefully, (4) properly stocking the pastures and managing grazing so that the pastures are not overgrazed, and (5) applying a fertilizer high in nitrogen on steep slopes seeded to bluegrass. In table 1 the yields shown for pasture on sandy or steep soils are for areas seeded to bluegrass and treated with a fertilizer high in nitrogen.

The estimates for yields of pasture are given in animal-unit-days. By animal-unit-days is meant the number of days during a normal growing season that 1 acre will provide grazing for an animal unit (one cow, horse, or steer; five hogs; or seven sheep) without injury to the pasture.

The estimates given in table 1 can be used to check the adequacy of the present system of management. If the average yields for the past 5 to 10 years are less than those indicated for the specific soil, the management and cropping system should be examined carefully. The management practices and cropping systems used should be compared with the suggestions given in the descriptions of capability units. By applying the practices suggested, yields can be increased.

Past management influences the fertility of the soils. Misuse of a good soil over a period of years may lower productivity so much that the casual observer would believe that the soil had little value for future use for crops. Knowledge of a badly damaged soil will help in determining what is needed to restore the soil to a high level of productivity.

The estimates of yields can be used to determine which management practices will give the greatest net returns. By consulting the yield table to find the predicted average yields and then turning to the section where the capability units are described, some idea about the needs for lime and fertilizer can be obtained.

Even higher yields than those shown in table 1 are possible. Many farmers can produce more corn than 100 bushels per acre. To do so, however, would require that especially large amounts of fertilizer be applied and that

TABLE 1.—*Predicted average acre yields of the principal field crops and pasture for the soils of the county under two levels of management*

[Absence of a yield figure indicates that the soil is not suited to the crop or that the crop is rarely grown]

Soils	Corn (grain)		Corn (silage)		Oats		Alfalfa-brome hay		Pasture [2]	
	Average	High	Average	High	Average	High [1]	Average	High	Average	High
	Bu.	*Bu.*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Animal-unit-days* [3]	*Animal-unit-days* [3]
Adrian muck									50	120
Alluvial land, loamy, nearly level [4]	50	70	11.0	13.0	40	50	1.8	3.0	95	135
Alluvial land, loamy, gently sloping [4]	50	70	11.0	13.0	40	50	1.8	3.0	95	135
Alluvial land, sandy [4]							1.6	2.0	20	40
Alluvial land, wet [4]									40	65
Almena silt loam, 0 to 2 percent slopes [5]	60	95	9.0	15.0	50	70	2.5	4.0	95	145
Almena silt loam, 2 to 6 percent slopes [5]	60	95	9.0	15.0	50	70	2.5	4.0	95	145
Almena silt loam, 2 to 6 percent slopes, moderately eroded [5]	55	90	8.5	14.5	45	65	2.3	3.8	90	140
Antigo silt loam, 0 to 2 percent slopes	60	80	11.0	15.0	50	80	2.5	3.2	85	120
Antigo silt loam, 2 to 6 percent slopes	60	80	11.0	15.0	50	80	2.5	3.2	85	120
Antigo silt loam, 2 to 6 percent slopes, moderately eroded	55	75	10.0	14.0	45	75	2.3	3.0	80	115
Arenzville silt loam [4]	65	105	10.0	14.0	50	62	2.8	3.5	110	145
Arland loam, 2 to 6 percent slopes	50	75	11.0	13.0	45	60	2.0	3.2	70	115
Arland loam, 6 to 12 percent slopes, moderately eroded	40	65	9.0	11.0	35	50	1.5	2.8	60	100
Auburndale silt loam [4]	50	90	8.0	11.0	45	60		4.0	80	130
Boone loamy fine sand, 2 to 6 percent slopes, eroded	30	45	4.0	7.0	20	35	1.0	1.8	35	60
Boone loamy fine sand, 6 to 12 percent slopes, eroded							.8	1.4	20	40
Boone fine sand, 12 to 35 percent slopes, eroded										
Burkhardt loam, 0 to 2 percent slopes	45	70	9.0	12.0	40	60	1.7	2.2	65	95
Burkhardt sandy loam, 0 to 2 percent slopes	40	65	8.0	11.0	35	55	1.6	2.2	60	90
Burkhardt sandy loam, 2 to 6 percent slopes	40	65	8.0	11.0	35	55	1.5	2.1	60	90
Chaseburg silt loam, 0 to 2 percent slopes [4]	70	105	11.0	15.0	55	65	3.0	4.0	110	145
Chaseburg silt loam, 2 to 6 percent slopes [4]	65	100	11.0	15.0	55	65	3.0	3.5	105	140
Chetek sandy loam, 2 to 6 percent slopes	40	65	8.0	11.0	35	55	1.5	2.1	55	90
Chetek sandy loam, 12 to 20 percent slopes, moderately eroded							1.0	1.8	42	75
Clyde silt loam [5]	55	95	9.0	15.0	45	60		4.0	100	145
Dakota loam, 0 to 2 percent slopes	60	80	10.5	13.5	45	55	2.5	3.2	85	120
Dakota loam, 2 to 6 percent slopes	60	80	10.5	13.0	45	55	2.5	3.2	85	120
Dakota loam, 6 to 12 percent slopes, moderately eroded	50	70	9.0	11.5	40	50	2.0	3.0	80	110
Dakota loam, loamy substratum, 0 to 2 percent slopes	60	100	11.0	15.0	55	70	2.8	4.0	95	130
Dakota loam, loamy substratum, 2 to 6 percent slopes	60	100	11.0	14.5	55	70	2.8	4.0	95	130
Dakota loam, rock substratum, 0 to 2 percent slopes	60	80	10.5	13.5	45	55	2.5	3.2	85	120
Dakota loam, rock substratum, 2 to 6 percent slopes, eroded	55	75	10.0	12.5	40	50	2.3	3.0	80	110
Dakota sandy loam, 0 to 2 percent slopes	45	75	9.0	12.0	40	50	2.2	3.0	80	115
Dakota sandy loam, 2 to 6 percent slopes	45	75	8.5	11.5	40	50	2.1	3.0	80	115
Derinda silt loam, 0 to 2 percent slopes	55	80	9.5	13.5	50	65	2.5	4.0	90	125
Derinda silt loam, 2 to 6 percent slopes	55	80	9.0	13.0	50	65	2.5	4.0	85	120
Derinda silt loam, 2 to 6 percent slopes, moderately eroded	50	80	8.5	12.5	45	65	2.3	3.6	85	120
Derinda silt loam, 6 to 12 percent slopes	50	75	8.5	12.5	40	60	2.1	3.2	80	115
Derinda silt loam, 6 to 12 percent slopes, moderately eroded	45	70	8.0	12.0	40	55	2.0	3.0	75	115
Derinda silt loam, 12 to 20 percent slopes						53	1.9	2.8	70	110
Derinda silt loam, 12 to 20 percent slopes, moderately eroded							1.8	2.6	65	105
Derinda silt loam, 20 to 30 percent slopes					35	45	1.7	2.4	60	100
Derinda silt loam, acid variant, 6 to 12 percent slopes, moderately eroded	35	55	6	10	35	50	1.6	2.6	75	100
Derinda silt loam, acid variant, 12 to 20 percent slopes, eroded							1.4	2.2	60	90

See footnotes at end of table.

TABLE 1.—*Predicted average acre yields of the principal field crops and pasture for the soils of the county under two levels of management*—Continued

Soils	Corn (grain)		Corn (silage)		Oats		Alfalfa-brome hay		Pasture [2]	
	Average	High	Average	High	Average	High [1]	Average	High	Average	High
	Bu.	*Bu.*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Animal-unit-days* [3]	*Animal-unit-days* [3]
Dickinson fine sandy loam, 2 to 6 percent slopes, moderately eroded	60	80	10. 0	13. 0	50	60	2. 5	3. 5	90	125
Downs silt loam, 2 to 6 percent slopes	65	105	12. 0	15. 5	55	70	3. 0	4. 0	100	140
Downs silt loam, 2 to 6 percent slopes, moderately eroded	65	105	11. 5	15. 0	50	70	2. 8	4. 0	100	140
Downs silt loam, 6 to 12 percent slopes, moderately eroded	60	95	11. 0	14. 5	45	65	2. 7	3. 4	90	135
Dubuque silt loam, 0 to 2 percent slopes	60	95	11. 0	14. 0	50	65	2. 8	3. 8	95	140
Dubuque silt loam, 2 to 6 percent slopes	60	95	11. 0	14. 0	50	65	2. 8	3. 8	95	140
Dubuque silt loam, 2 to 6 percent slopes, moderately eroded	55	95	10. 5	13. 5	50	65	2. 8	3. 8	95	140
Dubuque silt loam, 6 to 12 percent slopes	55	90	10. 5	13. 0	50	60	2. 5	3. 5	90	135
Dubuque silt loam, 6 to 12 percent slopes, moderately eroded	50	85	10. 0	12. 5	45	55	2. 5	3. 3	90	135
Dubuque silt loam, 12 to 20 percent slopes	50	80	9. 5	12. 0	40	50	2. 4	3. 2	80	125
Dubuque silt loam, 12 to 20 percent slopes, moderately eroded	45	75	8. 5	11. 0	40	50	2. 2	3. 0	75	115
Dubuque silt loam, 20 to 30 percent slopes	-	-	-	-	-	-	2. 2	3. 0	75	115
Dubuque silt loam, 20 to 30 percent slopes, moderately eroded	-	-	-	-	-	-	2. 0	2. 8	70	110
Dubuque silt loam, 30 to 40 percent slopes	-	-	-	-	-	-	-	-	60	80
Dubuque soils, 2 to 6 percent slopes, severely eroded	45	80	7. 0	11. 0	40	50	2. 0	2. 8	75	120
Dubuque soils, 6 to 12 percent slopes, severely eroded	40	75	6. 5	10. 5	35	45	1. 8	2. 5	65	115
Dubuque soils, 12 to 20 percent slopes, severely eroded	-	-	-	-	-	-	1. 6	2. 3	55	110
Dunbarton silt loam, 2 to 6 percent slopes	50	75	9. 0	13. 0	45	60	2. 4	3. 5	80	125
Dunbarton silt loam, 2 to 6 percent slopes, moderately eroded	45	70	8. 5	12. 5	40	55	2. 2	3. 4	75	125
Dunbarton silt loam, 6 to 12 percent slopes	45	70	8. 5	12. 5	40	55	2. 0	3. 2	75	120
Dunbarton silt loam, 6 to 12 percent slopes, moderately eroded	40	65	8. 0	12. 0	40	50	1. 9	3. 0	70	115
Dunbarton silt loam, 12 to 20 percent slopes	-	-	-	-	-	-	1. 8	2. 8	65	105
Dunbarton silt loam, 12 to 20 percent slopes, moderately eroded	-	-	-	-	-	-	1. 8	2. 5	60	100
Dunbarton silt loam, 20 to 30 percent slopes	-	-	-	-	-	-	1. 7	2. 5	60	90
Dunbarton silt loam, 20 to 30 percent slopes, moderately eroded	-	-	-	-	-	-	1. 6	2. 4	55	85
Dunbarton complex, 6 to 12 percent slopes	45	70	8. 0	10. 0	40	55	2. 0	3. 0	70	110
Dunbarton complex, 6 to 12 percent slopes, moderately eroded	40	65	7. 5	9. 5	35	50	1. 9	2. 8	65	105
Dunbarton complex, 12 to 20 percent slopes	-	-	-	-	-	-	1. 8	2. 6	60	100
Dunbarton complex, 12 to 20 percent slopes, moderately eroded	-	-	-	-	-	-	1. 8	2. 5	60	100
Dunbarton complex, 20 to 30 percent slopes	-	-	-	-	-	-	1. 6	2. 3	55	90
Dunbarton complex, 20 to 30 percent slopes, moderately eroded	-	-	-	-	-	-	1. 5	2. 1	55	85
Edith soils, 6 to 12 percent slopes, eroded	-	-	-	-	-	-	1. 8	2. 6	70	110
Edith soils, 12 to 20 percent slopes	-	-	-	-	-	-	-	-	60	100
Edith soils, 12 to 20 percent slopes, moderately eroded	-	-	-	-	-	-	-	-	55	95
Edith soils, 20 to 30 percent slopes	-	-	-	-	-	-	-	-	50	85
Edith-Wykoff soils, 6 to 12 percent slopes, eroded	-	-	-	-	-	-	1. 8	2. 6	70	110
Edith-Wykoff soils, 12 to 20 percent slopes, eroded	-	-	-	-	-	-	-	-	55	95

See footnotes at end of table.

TABLE 1.—*Predicted average acre yields of the principal field crops and pasture for the soils of the county under two levels of management*—Continued

Soils	Corn (grain)		Corn (silage)		Oats		Alfalfa-brome hay		Pasture [2]	
	Average	High	Average	High	Average	High [1]	Average	High	Average	High
	Bu.	*Bu.*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Animal-unit-days* [3]	*Animal-unit-days* [3]
Edith-Wykoff soils, 12 to 20 percent slopes, severely eroded									50	85
Edith-Wykoff soils, 20 to 30 percent slopes									45	75
Fayette silt loam, benches, 0 to 2 percent slopes	65	105	11.0	13.0	55	70	3.0	4.0	95	130
Fayette silt loam, benches, 2 to 6 percent slopes	65	105	10.5	13.0	55	70	3.0	4.0	95	130
Fayette silt loam, benches, 6 to 12 percent slopes, moderately eroded	58	95	9.0	11.0	45	55	2.6	3.5	80	125
Floyd silt loam, 2 to 6 percent slopes [5]	60	90	10.0	13.0	45	60	2.0	4.0	110	145
Freeon silt loam, 2 to 6 percent slopes, moderately eroded	55	85	10.5	13.0	60	80	2.6	4.0	105	135
Freeon silt loam, 6 to 12 percent slopes, moderately eroded	50	80	9.0	11.5	55	75	2.5	4.0	100	135
Freer silt loam [5]	50	70	9.0	15.0	50	80		4.0	95	130
Gale silt loam, 2 to 6 percent slopes	60	85	10.0	13.0	50	70	2.8	3.2	75	115
Gale silt loam, 2 to 6 percent slopes, moderately eroded	55	80	9.5	13.0	45	70	2.6	3.5	75	115
Gale silt loam, 6 to 12 percent slopes, eroded	50	75	8.5	11.0	40	65	2.2	3.0	70	105
Gale silt loam, 12 to 20 percent slopes, moderately eroded	40	60	8.0	10.0	35	55	1.8	2.4	65	100
Gale silt loam, thin solum variant, 6 to 12 percent slopes, eroded	40	65	7.0	11.0	35	50	1.8	2.6	70	110
Gale silt loam, thin solum variant, 12 to 20 percent slopes							1.6	2.4	65	100
Gale silt loam, thin solum variant, 12 to 20 percent slopes, moderately eroded							1.4	2.0	60	80
Gale silt loam, thin solum variant, 20 to 30 percent slopes									50	70
Halder loam, 0 to 2 percent slopes [5]	50	85	8.0	14.0	50	70	2.0	3.5	100	135
Halder loam, sandy substratum, 0 to 3 percent slopes	45	80	8.0	14.0	45	65	2.6	3.5	70	110
Hesch fine sandy loam, loamy substratum, 2 to 6 percent slopes, moderately eroded	50	75	9.0	12.0	45	55	2.4	3.0	75	115
Hesch fine sandy loam, loamy substratum, 6 to 12 percent slopes, moderately eroded	45	65	8.0	11.0	40	50	2.2	2.8	65	105
Hesch fine sandy loam, loamy substratum, 12 to 20 percent slopes, eroded	35	55	7.0	10.0	30	40	1.6	2.4	60	95
Hesch loam, loamy substratum, 2 to 6 percent slopes	60	100	11.0	14.5	55	70	3.0	4.0	95	130
Hesch loam, loamy substratum, 2 to 6 percent slopes, moderately eroded	55	95	10.5	14.0	50	65	2.8	3.8	90	120
Hesch loam, loamy substratum, 6 to 12 percent slopes, moderately eroded	50	85	9.5	13.0	40	60	2.6	3.4	80	115
Hesch loam, loamy substratum, 12 to 20 percent slopes, moderately eroded	45	75	8.0	12.0	35	55	2.4	3.0	75	110
Hixton fine sandy loam, 6 to 12 percent slopes, moderately eroded	40	65	7.0	10.0	35	45	1.6	2.4	60	90
Hixton fine sandy loam, 12 to 20 percent slopes, moderately eroded							1.2	2.2	50	80
Hixton fine sandy loam, loamy substratum, 2 to 6 percent slopes	55	75	9.5	12.5	45	55	2.4	3.0	80	120
Hixton fine sandy loam, loamy substratum, 2 to 6 percent slopes, moderately eroded	50	75	9.0	12.0	45	55	2.3	3.0	75	115
Hixton fine sandy loam, loamy substratum, 6 to 12 percent slopes	50	70	8.5	11.5	40	55	2.2	2.9	65	105
Hixton fine sandy loam, loamy substratum, 6 to 12 percent slopes, moderately eroded	45	65	8.0	11.0	40	50	2.0	2.8	65	100
Hixton fine sandy loam, loamy substratum, 12 to 20 percent slopes	40	60	7.5	10.5	35	45	1.8	2.6	60	100

See footnotes at end of table.

TABLE 1.—*Predicted average acre yields of the principal field crops and pasture for the soils of the county under two levels of management*—Continued

Soils	Corn (grain)		Corn (silage)		Oats		Alfalfa-brome hay		Pasture [2]	
	Average	High	Average	High	Average	High [1]	Average	High	Average	High
	Bu.	*Bu.*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Animal-unit-days* [3]	*Animal-unit-days* [3]
Hixton fine sandy loam, loamy substratum, 12 to 20 percent slopes, moderately eroded	35	55	7. 0	10. 0	30	40	1. 6	2. 4	60	95
Hixton fine sandy loam, loamy substratum, 20 to 30 percent slopes	-------	-------	-------	-------	-------	-------	1. 4	2. 2	55	90
Hixton loam, loamy substratum, 2 to 6 percent slopes	60	100	10. 5	14. 0	55	70	3. 0	4. 0	95	130
Hixton loam, loamy substratum, 6 to 12 percent slopes, moderately eroded	50	85	9. 0	12. 5	45	60	2. 4	3. 4	80	115
Hixton loam, loamy substratum, 12 to 20 percent slopes, eroded	45	75	8. 0	11. 5	35	50	2. 2	3. 0	70	105
Lamont very fine sandy loam, 2 to 6 percent slopes, moderately eroded	55	75	9. 0	12. 0	45	55	2. 3	3. 0	70	105
Lamont very fine sandy loam, 6 to 12 percent slopes, moderately eroded	45	65	8. 0	11. 0	40	50	2. 0	2. 8	65	95
Lamont very fine sandy loam, 12 to 20 percent slopes, moderately eroded	35	55	7. 0	10. 0	30	40	1. 6	2. 4	55	85
Lawler loam, 0 to 3 percent slopes [5]	50	85	8. 0	14. 0	50	65	2. 0	3. 5	70	110
Lawler silt loam, 0 to 2 percent slopes [5]	50	85	8. 0	14. 0	50	65	2. 0	3. 5	70	110
Lawler silt loam, 2 to 6 percent slopes [5]	50	85	8. 0	14. 0	50	65	2. 0	3. 5	70	110
Meridian loam, 0 to 2 percent slopes	55	85	10. 5	13. 0	50	75	2. 2	3. 2	70	120
Meridian loam, 2 to 6 percent slopes	55	80	10. 0	12. 5	50	75	2. 0	3. 0	65	115
Onamia loam, 0 to 2 percent slopes	55	80	10. 5	13. 0	50	75	2. 2	3. 2	70	120
Onamia loam, 2 to 6 percent slopes	55	80	10. 0	12. 5	50	75	2. 0	3. 0	65	115
Onamia loam, 2 to 6 percent slopes, moderately eroded	50	75	9. 5	12. 0	45	70	1. 8	2. 8	60	110
Onamia loam, 6 to 12 percent slopes, moderately eroded	40	70	9. 0	11. 0	35	60	1. 5	2. 5	50	95
Onamia loam, 12 to 20 percent slopes, moderately eroded	40	65	8. 0	10. 0	35	55	1. 3	2. 3	45	95
Onamia sandy loam, 2 to 6 percent slopes	45	70	8. 5	11. 5	40	50	2. 1	3. 0	80	110
Onamia sandy loam, 6 to 12 percent slopes, moderately eroded	35	65	7. 0	10. 0	30	40	1. 8	2. 6	65	95
Orion silt loam [4]	50	95	10. 0	14. 0	40	55	2. 0	3. 5	95	145
Ostrander silt loam, 0 to 2 percent slopes	70	95	10. 5	13. 5	60	75	3. 0	4. 0	95	140
Ostrander silt loam, 2 to 6 percent slopes	65	95	10. 5	13. 0	55	75	2. 8	4. 0	90	140
Ostrander silt loam, 2 to 6 percent slopes, moderately eroded	60	85	10. 0	12. 5	50	75	2. 6	3. 8	85	135
Ostrander silt loam, 6 to 12 percent slopes, moderately eroded	55	80	9. 0	11. 5	45	70	2. 4	3. 6	80	130
Otterholt silt loam, 2 to 6 percent slopes	65	100	11. 0	14. 0	55	70	3. 0	4. 0	95	140
Otterholt silt loam, 2 to 6 percent slopes, moderately eroded	60	100	10. 5	13. 5	50	70	2. 8	4. 0	90	135
Otterholt silt loam, 6 to 12 percent slopes	60	100	10. 5	13. 0	50	65	2. 8	4. 0	90	135
Otterholt silt loam, 6 to 12 percent slopes, moderately eroded	55	100	10. 0	12. 5	45	65	2. 6	3. 8	85	130
Otterholt silt loam, 6 to 12 percent slopes, severely eroded	50	95	9. 5	11. 5	40	60	2. 1	3. 0	70	120
Otterholt silt loam, 12 to 20 percent slopes, moderately eroded	45	90	9. 0	11. 0	35	55	2. 2	3. 0	70	115
Plainfield loamy sand, 0 to 2 percent slopes	25	40	5. 0	8. 0	25	35	1. 0	1. 5	35	60
Plainfield loamy sand, 2 to 6 percent slopes	25	40	4. 5	7. 5	25	35	1. 0	1. 5	35	55
Plainfield loamy sand, 2 to 6 percent slopes, eroded	20	35	4. 0	7. 0	20	30	. 8	1. 4	30	50
Plainfield loamy sand, 6 to 12 percent slopes	-------	-------	-------	-------	-------	-------	. 8	1. 2	30	50
Plainfield loamy sand, 6 to 12 percent slopes, eroded	-------	-------	-------	-------	-------	-------	. 6	1. 0	25	45
Port Byron silt loam, 0 to 2 percent slopes	70	105	12. 5	16. 0	60	75	2. 5	4. 0	105	145
Port Byron silt loam, 2 to 6 percent slopes	70	105	12. 0	15. 5	60	75	2. 5	4. 0	105	145
Port Byron silt loam, 6 to 12 percent slopes, moderately eroded	60	95	11. 0	14. 0	50	65	2. 1	3. 6	95	130

See footnotes at end of table.

TABLE 1.—*Predicted average acre yields of the principal field crops and pasture for the soils of the county under two levels of management*—Continued

Soils	Corn (grain)		Corn (silage)		Oats		Alfalfa-brome hay		Pasture [2]	
	Average	High	Average	High	Average	High [1]	Average	High	Average	High
	Bu.	*Bu.*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Animal-unit-days* [3]	*Animal-unit-days* [3]
Racine silt loam, 2 to 6 percent slopes	65	90	10. 5	13. 0	55	75	2. 8	4. 0	90	135
Racine silt loam, 2 to 6 percent slopes, moderately eroded	60	85	10. 0	12. 5	50	75	2. 6	3. 8	80	130
Racine silt loam, 6 to 12 percent slopes, moderately eroded	55	80	9. 0	11. 5	45	70	2. 4	3. 6	75	125
Renova silt loam, 0 to 2 percent slopes	65	100	10. 5	13. 5	60	75	3. 0	4. 0	90	135
Renova silt loam, 2 to 6 percent slopes	65	95	10. 5	13. 0	55	75	2. 8	4. 0	90	135
Renova silt loam, 2 to 6 percent slopes, moderately eroded	60	95	10. 0	12. 5	55	75	2. 6	3. 8	80	130
Renova silt loam, 6 to 12 percent slopes	60	90	9. 5	12. 0	50	70	2. 6	3. 8	80	130
Renova silt loam, 6 to 12 percent slopes, moderately eroded	55	85	9. 0	11. 5	45	70	2. 4	3. 6	75	125
Renova silt loam, 6 to 12 percent slopes, severely eroded	45	80	8. 5	11. 0	35	65	2. 0	3. 2	65	120
Renova silt loam, 12 to 20 percent slopes	50	80	8. 5	11. 0	40	65	2. 2	3. 2	70	120
Renova silt loam, 12 to 20 percent slopes, moderately eroded	45	75	8. 0	10. 5	35	60	2. 0	3. 0	65	115
Renova silt loam, 12 to 20 percent slopes, severely eroded	----	----	----	----	----	----	1. 6	2. 5	55	105
Renova fine sandy loam, sandy variant, 2 to 6 percent slopes, eroded	50	75	9. 0	12. 0	40	55	2. 3	3. 0	75	115
Renova fine sandy loam, sandy variant, 6 to 12 percent slopes, eroded	45	65	8. 0	11. 0	35	45	1. 8	2. 6	65	100
Renova fine sandy loam, sandy variant, 12 to 20 percent slopes, eroded	40	60	7. 0	10. 0	30	40	1. 7	2. 3	60	95
Riverwash	----	----	----	----	----	----	----	----	----	----
Rockton complex, 2 to 6 percent slopes	60	90	9. 0	13. 0	50	70	2. 6	3. 6	75	115
Rockton complex, 6 to 12 percent slopes, moderately eroded	50	80	8. 0	12. 0	40	60	2. 2	3. 0	70	105
Rozetta silt loam, benches, 0 to 2 percent slopes	65	110	11. 0	14. 0	55	70	3. 0	4. 0	100	145
Rozetta silt loam, benches, 2 to 6 percent slopes	65	105	10. 5	13. 5	55	65	3. 0	4. 0	95	140
Sable silt loam [5]	50	95	9. 0	15. 0	45	60	----	4. 0	100	135
Santiago silt loam, 2 to 6 percent slopes	60	90	10. 5	13. 0	55	75	2. 8	4. 0	90	135
Santiago silt loam, 2 to 6 percent slopes, moderately eroded	55	85	10. 0	12. 5	50	70	2. 6	3. 8	80	130
Santiago silt loam, 6 to 12 percent slopes, moderately eroded	50	80	9. 0	11. 5	45	65	2. 4	3. 6	75	125
Sargeant silt loam, 0 to 2 percent slopes [4]	45	80	9. 5	13. 5	50	80	2. 0	4. 0	95	130
Sargeant silt loam, 2 to 6 percent slopes [4]	45	80	9. 0	13. 0	50	80	2. 0	4. 0	95	130
Sargeant silt loam, 2 to 6 percent slopes, moderately eroded.[4]	40	75	8. 5	12. 5	45	75	1. 8	3. 8	90	125
Sargeant silt loam, 6 to 12 percent slopes [4]	40	75	8. 0	12. 0	45	70	1. 8	3. 8	90	120
Sargeant silt loam, 6 to 12 percent slopes, moderately eroded [4]	35	70	7. 5	11. 5	40	65	1. 6	3. 6	85	115
Schapville silt loam, 6 to 12 percent slopes	45	70	8. 5	12. 5	45	60	2. 2	3. 4	80	125
Schapville silt loam, 6 to 12 percent slopes, moderately eroded	40	70	8. 0	12. 0	40	55	2. 0	3. 2	75	120
Schapville silt loam, 12 to 20 percent slopes, moderately eroded	----	----	----	----	----	----	1. 8	2. 8	65	105
Schapville silt loam, 20 to 30 percent slopes, eroded	----	----	----	----	----	----	1. 6	2. 6	60	95
Schapville silt loam, wet subsoil variant, 2 to 6 percent slopes, eroded [4]	40	70	8. 5	12. 5	50	65	2. 0	3. 5	70	110
Seaton silt loam, 2 to 6 percent slopes	65	100	11. 5	16. 0	55	70	3. 0	4. 0	95	140
Seaton silt loam, 2 to 6 percent slopes, moderately eroded	60	95	11. 0	16. 0	50	70	2. 8	3. 7	90	135
Seaton silt loam, 6 to 12 percent slopes	60	95	10. 5	15. 5	50	65	2. 8	3. 6	90	135
Seaton silt loam, 6 to 12 percent slopes, moderately eroded	55	90	10. 0	15. 0	45	60	2. 6	3. 4	85	130
Seaton silt loam, 6 to 12 percent slopes, severely eroded	50	85	8. 5	14. 0	40	50	2. 4	3. 2	80	125
Seaton silt loam, 12 to 20 percent slopes	55	80	9. 0	14. 5	40	55	2. 4	3. 0	85	130

See footnotes at end of table.

TABLE 1.—*Predicted average acre yields of the principal field crops and pasture for the soils of the county under two levels of management*—Continued

Soils	Corn (grain)		Corn (silage)		Oats		Alfalfa-brome hay		Pasture [2]	
	Average	High	Average	High	Average	High [1]	Average	High	Average	High
	Bu.	*Bu.*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Aminal-unit-days* [3]	*Animal-unit-days* [3]
Seaton silt loam, 12 to 20 percent slopes, moderately eroded	45	85	8. 5	14. 0	40	50	2. 2	2. 8	80	120
Seaton silt loam, 12 to 20 percent slopes, severely eroded	40	70	7. 5	13. 0	35	50	2. 0	2. 7	70	115
Seaton silt loam, 20 to 30 percent slopes	-----	-----	-----	-----	-----	-----	2. 2	2. 8	75	110
Seaton silt loam, 20 to 30 percent slopes, moderately eroded	-----	-----	-----	-----	-----	-----	2. 0	2. 6	70	110
Sogn-Rockton loams, 0 to 2 percent slopes	45	70	8. 0	10. 5	45	65	2. 4	3. 5	80	110
Sogn-Rockton loams, 2 to 6 percent slopes	45	70	7. 5	10. 0	45	65	2. 2	3. 4	75	105
Sogn-Rockton loams, 6 to 12 percent slopes, moderately eroded	40	65	6. 5	9. 0	40	60	2. 0	3. 1	70	100
Sogn-Rockton loams, 12 to 20 percent slopes, moderately eroded	-----	-----	-----	-----	-----	-----	1. 7	2. 6	65	90
Sparta loamy sand, 0 to 2 percent slopes	30	45	5. 0	8. 0	30	40	1. 2	1. 5	40	65
Sparta loamy sand, 2 to 6 percent slopes	30	45	4. 5	7. 5	30	40	1. 2	1. 5	40	65
Sparta loamy sand, 2 to 6 percent slopes, eroded	25	40	4. 0	7. 0	25	35	1. 1	1. 4	35	55
Sparta loamy sand, 6 to 12 percent slopes, eroded	-----	-----	-----	-----	-----	-----	1. 0	1. 2	30	45
Spencer silt loam, 0 to 2 percent slopes	60	105	11. 0	13. 0	55	65	3. 0	4. 0	90	135
Spencer silt loam, 2 to 6 percent slopes	60	105	10. 5	13. 0	55	65	3. 0	4. 0	90	135
Spencer silt loam, 2 to 6 percent slopes, moderately eroded	55	105	10. 0	12. 0	50	65	2. 8	3. 7	85	130
Spencer silt loam, 6 to 12 percent slopes, moderately eroded	50	100	9. 0	11. 5	45	60	2. 6	3. 4	80	120
Steep stony and rocky land	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stronghurst silt loam, benches, 0 to 2 percent slopes [5]	50	90	10. 0	12. 0	45	60	2. 0	4. 0	90	130
Tell silt loam, 0 to 2 percent slopes	60	90	10. 5	13. 5	50	75	2. 8	3. 8	80	120
Tell silt loam, 2 to 6 percent slopes, eroded	55	85	9. 5	12. 5	45	70	2. 6	3. 6	75	115
Terrace escarpments, loamy	-----	-----	-----	-----	-----	-----	1. 5	2. 0	50	58
Terrace escarpments, sandy	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Terril loam [4]	65	110	10. 0	14. 0	55	65	3. 0	3. 7	115	150
Vlasaty silt loam, 2 to 6 percent slopes	60	95	10. 0	13. 0	55	70	2. 6	4. 0	85	130
Vlasaty silt loam, 2 to 6 percent slopes, moderately eroded	55	90	9. 5	12. 0	50	70	2. 4	3. 8	80	125
Vlasaty silt loam, 6 to 12 percent slopes	55	90	9. 0	11. 5	45	65	2. 3	3. 6	75	120
Vlasaty silt loam, 6 to 12 percent slopes, moderately eroded	50	85	8. 5	11. 0	40	65	2. 2	3. 5	65	115
Waukegan silt loam, 0 to 2 percent slopes	60	95	10. 0	14. 0	55	75	3. 0	4. 0	90	130
Waukegan silt loam, 2 to 6 percent slopes	60	90	9. 5	14. 0	50	70	2. 8	3. 8	85	125
Whalan silt loam, 0 to 2 percent slopes	60	90	10. 5	14. 0	50	75	2. 8	3. 8	80	120
Whalan silt loam, 2 to 6 percent slopes	60	90	10. 5	13. 5	50	75	2. 8	3. 8	80	51
Whalan silt loam, 2 to 6 percent slopes, moderately eroded	55	85	10. 0	13. 0	45	70	2. 6	3. 6	75	112
Whalan silt loam, 6 to 12 percent slopes	55	85	9. 5	13. 0	45	70	2. 4	3. 4	75	115
Whalan silt loam, 6 to 12 percent slopes, moderately eroded	50	80	9. 0	12. 5	40	65	2. 2	3. 2	70	110
Whalan silt loam, 12 to 20 percent slopes	50	80	9. 0	12. 0	40	65	2. 2	3. 2	70	105
Whalan silt loam, 12 to 20 percent slopes, moderately eroded	45	75	8. 5	11. 5	35	60	2. 0	3. 0	65	100
Whalan silt loam, 12 to 20 percent slopes, severely eroded	-----	-----	-----	-----	-----	-----	1. 8	2. 8	60	90
Whalan silt loam, 20 to 30 percent slopes	-----	-----	-----	-----	-----	-----	1. 9	3. 0	60	90
Whalan silt loam, 20 to 30 percent slopes, moderately eroded	-----	-----	-----	-----	-----	-----	1. 8	2. 8	55	85
Worthen silt loam	65	110	10. 0	14. 0	55	65	3. 0	3. 7	115	150
Wykoff loam, 2 to 6 percent slopes	55	80	10. 0	13. 0	45	65	2. 6	3. 5	70	110
Wykoff loam, 2 to 6 percent slopes, moderately eroded	50	80	9. 5	12. 5	45	65	2. 5	3. 3	70	105
Wykoff loam, 6 to 12 percent slopes	50	80	9. 0	12. 5	40	60	2. 3	3. 1	70	100
Wykoff loam, 6 to 12 percent slopes, moderately eroded	45	75	8. 5	12. 0	40	60	2. 1	3. 0	65	95
Wykoff loam, 6 to 12 percent slopes severely eroded	40	70	8. 0	11. 0	35	55	1. 9	2. 8	60	90

See footnotes at end of table.

TABLE 1.—*Predicted average acre yields of the principal field crops and pasture for the soils of the county under two levels of management*—Continued

Soils	Corn (grain)		Corn (silage)		Oats		Alfalfa-brome hay		Pasture [2]	
	Average	High	Average	High	Average	High [1]	Average	High	Average	High
	Bu.	*Bu.*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Animal-unit-days* [3]	*Animal-unit-days* [3]
Wykoff loam, 12 to 20 percent slopes	40	70	9. 0	12. 0	35	55	2. 0	2. 8	60	95
Wykoff loam, 12 to 20 percent slopes, moderately eroded	40	65	8. 0	11. 0	35	55	1. 8	2. 6	55	85
Wykoff loam, 12 to 20 percent slopes, severely eroded							1. 6	2. 4	50	80
Wykoff silt loam, 2 to 6 percent slopes	55	80	10. 0	13. 0	45	65	2. 6	3. 5	70	110
Wykoff silt loam, 2 to 6 percent slopes, moderately eroded	50	80	9. 5	12. 5	45	65	2. 5	3. 3	70	105
Wykoff silt loam, 6 to 12 percent slopes, eroded	45	75	8. 5	12. 0	40	60	2. 1	3. 0	65	95

[1] Yields obtained where the most disease-resistant varieties of crops are planted and the weeds are controlled.

[2] Bluegrass and associated species.

[3] Animal-unit-days is a term used to express the carrying capacity of pasture. It is the number of days the pasture is grazed during a single grazing season without injury to the sod. An acre of pasture that provides 30 days of grazing for two cows has a carrying capacity of 60 animal-unit-days.

[4] Adequate drainage and protection from overflow required for optimum yields.

[5] Management used to obtain high yields includes excellent drainage.

careful management be used. The county agent or personnel of the agricultural experiment station can be consulted about testing the soils and about the kinds and amounts of fertilizer and lime to apply.

Woodland Uses of the Soils [2]

Originally, about 70 percent of the land area of Pierce County was wooded, but today, woodland occupies slightly less than 24 percent of the acreage. Many of the trees were cut when logging became extensive during the period 1840–1850, and logging continued to be extensive from then until the turn of the century. It declined in importance after that, and it now makes up only a minor part of the economy of the county. At the present time, about two-thirds of the allowable cut is harvested each year.

Commercial forests, mainly in farm woodlots, occupy approximately 89,600 acres in the county. Of this acreage, the stands on some 58,900 acres are poorly stocked. The soils that occupy about 3,400 acres are suitable for the planting of trees.

Forest stands have deteriorated in this county, partly because of the practice of grazing wooded areas. About half of the acreage in woods has been subjected to intensive grazing, and this practice has seriously interfered with the regeneration of trees. Burning, a practice detrimental to woodland, has been largely eliminated. In the present forests, saw logs, fuelwood, posts, pulpwood, and maple sirup are the main products. Not much pulpwood is harvested, however, because of the long distance to market.

Woodland suitability groups

The soils of Pierce County have been placed in woodland suitability groups to assist owners of woodland in planning the use of their soils. Soils that give similiar response to use and management have been grouped together. In discussing these groups, the productivity of the soils and the various factors that affect management have been taken into consideration. Factors that affect management include hazards that influence the survival of seedlings, as well as the hazard of erosion, equipment limitations, the hazard of windthrow, species suitability, and the effects of soil-associated diseases, insects, and animals.

The kind and quantity of wood products that can be grown in a given area largely determine the kind of management that is needed. Not all soils produce at the same rate; annual yields of timber may range from none to several hundred board feet per acre. Also, areas now producing hardwoods may or may not be suitable for pines. Soils on which trees of low value now grow, however, may be good locations for more valuable species. Therefore, it is important to learn as much as possible about the suitability of the soils for different kinds of trees. Information given in the descriptions of suitability groups can be used along with other information in the soil survey to determine the kinds of trees that grow best on a given soil. It can also be used to determine the kind of management needed.

Each suitability group is discussed in the pages that follow. For each group are named the hazards, equipment limitations, and species that should be favored in the stand or that should be used for planting. The groups have been numbered according to a statewide system. Groupings 2, 6 and 8 do not occur in Pierce County and are, therefore, not discussed. To find the names of the soils in any given group, refer to the "Guide to Mapping Units" at the back of the soil survey.

For each group, a site index rating is given for suitable trees. Stated simply, site index refers to the average total height of the dominant trees in the stand at 50 years of age. It is considered to be one of the best indi-

[2] By ROBERT E. GREENLAW, woodland conservationist, Soil Conservation Service.

cators of potential soil productivity. The site index of many of these soils was determined from measurements made by a team of foresters and soil scientists working together. Woodland sites suitable for measurements were not available for all of the soils. Where a woodland site was not available, similar soils were used for comparison. For most of the groups, the normal range that might be expected in a group of soils is shown. To help in predicting productivity, these figures have been applied to the best available tables of normal yields supplied by research foresters.

Also discussed for each suitability group are the hazards of seedling mortality, or the loss of seedlings as related to the kinds of soils; the risk of competition from undesirable plants; the limitations to the use of equipment; the hazards to seedlings from diseases, insects, or animals; and the hazards of windthrow and erosion. A rating of *slight* means that no special problems are recognized, and that the use of the soils for trees would not be affected by that special hazard, except as indicated in the descriptions of the groups. A rating of *moderate* means that the use of the soils for trees would be affected by the stated hazard, but not to the extent of precluding such use, and that ordinary management practices can be used to control the hazard. A rating of *severe* means that the stated hazard makes it impractical to manage the soils for trees, or that difficult or expensive practices are required for control of the hazard. Also discussed are the kinds of trees that grow best on the soils of each group.

WOODLAND SUITABILITY GROUP 1

The soils of this group are moderately deep or deep, well drained or moderately well drained, and medium textured. Their slopes range from 0 to more than 12 percent. These soils have the highest potential for production of timber of any soils in the county. They are deep enough that roots develop well, and they have high moisture-supplying capacity, high fertility, and good internal drainage. Because these soils are desirable for agriculture, however, stands of timber generally occupy only small, isolated areas.

The native vegetation on these soils was mainly northern red oak, maple, basswood, and white oak. Now, aspen, a pioneer species, generally grows in areas that have been burned over. Black oak generally grows on the uppermost eroded slopes and on the drier sites.

The site index for red oaks growing on these soils ranges from 56 to 75. It is about the same on slopes that face north as on slopes that face south. Normally, the site index is higher on the middle and lower parts of the slopes than on the ridgetops.

As a rule, hardwoods that grow on the soils of this group are tall and have well-formed stems. They produce saw logs and veneer of high quality. Eroded soils on the upper parts of the slopes are used mainly for producing posts and saw logs, but the saw logs are of poor quality.

Regeneration of oak is difficult on these soils. Enough seed is normally produced for a good stand, but many of the seeds and seedlings are destroyed by rodents and insects. The acorn weevil is the most destructive agent. Sometimes, it damages as much as 90 percent of a crop of acorns. Oaks require much light. Maple, ash, elm, and basswood are more tolerant of shade than oaks. They generally become established if an adequate supply of seed is available. Scarifying the soils also increases the likelihood that oaks will reproduce adequately.

Natural stands of white pine and of Norway pine are not common in this county. These trees grow well on the soils of this group, however, if they are planted. Competition from brush, grass, and weeds is severe unless adequate measures to control them are used. Scalping, furrowing, or clear tilling the site before the trees are planted reduces this competition.

Herbicides can be used effectively in some places to control undesirable plants. In plantations of young pines, the grass should be controlled to reduce competition and to reduce the hazard of damage from field mice and other rodents.

On the soils of group 1, stands of hardwoods can be managed for the production of saw timber or veneer of high quality. The more favorable sites, the coves and the slopes that face north or east for example, are well suited to maple, basswood, red oak, and white pine grown for timber. The less favorable exposures that face south and west are suitable for red oak.

Planted hardwoods have generally been unsuccessful on these soils, but planted white pine, Norway pine, and white spruce grow well. Stands of aspen and paper birch growing on these soils should be clear cut at about 40 to 45 years of age, and white pine, Norway pine, or white spruce should be planted in their place. The best species for farm windbreaks in this county are white pine, white spruce, and white-cedar.

Frost, frost heaving, and drowning are slight hazards to establishing stands of trees on these soils. Heat and drought are minor hazards to trees planted on slopes that face north and east, but they are moderate hazards to trees planted on slopes that face south and west. Damage from insects is generally moderate, except in grassy areas, where white grubs may seriously damage the roots of trees. Locally, damping-off fungi sometimes damage seedlings of conifers, and white pine blister rust is a hazard in some places where currants and gooseberries are prevalent. In some areas deer and rabbits cause severe damage to new seedlings.

On the nearly level to moderately sloping soils, the hazards limiting the establishment and survival of seedlings are drought, wetness, and competition from other plants. The hazards of drought and wetness are slight, but the hazard of competition from other plants is severe. Erosion is a slight hazard.

Limitations to the use of equipment for planting trees and harvesting timber are slight, and the hazard of windthrow is slight. The use of equipment is limited only by temporary wetness of the soils, caused by a large amount of rainfall or by thawing in spring. Heavy logging equipment may cause some damage to the soils through compaction. Logging in winter causes less damage to the soils and the timber than logging at other times.

Maple, basswood, red oak, and white pine are the species that should be favored in the present stands. White pine, Norway pine, and white spruce are the most favorable trees for planting.

On the moderately sloping to very steep soils, the hazards limiting the establishment and survival of seed-

lings are drought and competition from other plants. The hazard of drought is slight, but the hazard of competition from other plants is severe. Erosion is a moderate hazard.

Limitations to the use of equipment for planting trees and harvesting timber are moderate to severe on these soils. The hazard of windthrow is slight. The use of machinery for planting trees and the activities needed for controlling fires are limited by the moderate to very steep slopes. Where the slopes are steeper than 12 percent, logging roads and fire access lanes should be located on the ridges or on the contour. Skidding the logs uphill will make erosion a less serious hazard than if they are skidded downhill.

Maple, basswood, red oak, and white pine are the species that should be favored in the present stands. White pine, Norway pine, and white spruce are the most favorable trees for planting.

On the well drained or moderately well drained soils that formed in alluvium under forest, the hazards limiting the establishment and survival of seedlings are drought, wetness, and competition from other plants. The hazards of drought and wetness are slight, but the hazard of competition from other plants is severe. Erosion is a slight hazard.

Limitations to the use of equipment for planting trees and harvesting timber are moderate on the soils formed in alluvium. The hazard of windthrow is slight.

Maple, basswood, red oak, and white pine are the species that should be favored in existing stands. White pine, white spruce, and Norway pine are the most favorable trees for planting.

WOODLAND SUITABILITY GROUP 3

Moderately deep and deep, moderately coarse textured soils, and deep, coarse-textured soils that have a substratum finer textured than the material above it, make up this woodland suitability group. The soils are somewhat excessively drained to moderately well drained.

The natural stands on these soils consist of aspen, paper birch, Norway pine, white pine, black oak, and northern pin oak. The principal forest products are pulpwood, fuelwood, and saw timber.

These soils are poor for oaks (site index of 40 to 48). Generally, they are good for Norway pine (site index of 65 to 75), and they are also good for white pine, aspen, and jack pine. Where erosion is moderately severe, however, these soils are poor for all species except jack pine. They do have medium suitability for jack pine.

Frost is of little danger to seedlings on these soils. Damage from heat or drought can be severe on the eroded soils and on the south-facing slopes, but it is likely to be moderate on the other sites. Competition from other plants is generally not a problem, except for a few patches of brush on the north-facing slopes. Except for occasional stoniness and the usual limitations of steep topography, there are no special limitations to the use of equipment for planting, harvesting of timber, or fire control. Normally, pines should be favored over hardwoods in managing the woodland in this county.

The Zimmerman pine moth, the pine sawfly, which has been introduced, and white grubs are the main injurious insects. The hazard of damage by insects is rated as moderate to severe. Locally, oak wilt can be a severe problem, and occasionally, rodents are a moderate problem. In some areas rabbits and deer are detrimental to young trees, especially to new plantations.

On the soils that have slopes of less than 12 percent, the establishment and the survival of seedlings are limited by moderate hazards of drought and of competition from other plants. Erosion is a severe hazard.

Limitations to the use of equipment for planting trees and harvesting timber are slight. Windthrow is a slight hazard.

White pine, Norway pine, jack pine, and red oak are the species to favor in the stand. White pine and Norway pine are the most favorable trees for planting.

On the soils that have slopes of more than 12 percent, moderate hazards of drought and of competition from other plants limit the establishment and survival of seedlings, and there is a severe hazard of drought. The hazard of erosion is severe.

Limitations to the use of equipment for planting trees and harvesting timber are moderate to severe. The hazard of windthrow is slight.

White pine, Norway pine, jack pine, and red oak are the species to favor in the stand. White pine and Norway pine are the most favorable trees for planting.

WOODLAND SUITABILITY GROUP 4

The soils of this group are excessively drained. Trees growing on them are subject to drought.

The native vegetation on these soils was mainly northern pin oak, jack pine, Norway pine, and white pine. Brush, grass, and weeds are common on the steep or eroded sites.

Individual measurements of representative stands of oaks growing on these soils show that the site index ranges from 35 to 45, but that it is generally about 40. Measurements of stands of pines indicate that the site index for pines is much higher than for oaks. The site index for Norway pine is 70 to 75, and the site index for jack pine is 60 to 65. Because the quality of the timber is poor and yields are low, it is questionable whether oaks should be grown. The owner or manager of a stand of oaks should seriously consider converting the stand to pine.

The preferred species for planting is Norway pine on the less sloping and less eroded areas of these soils, and jack pine on the steeper slopes and in the eroded spots. White pine may be underplanted in poor stands of oak.

Heat and drought are rated as moderate hazards that cause seedling mortality on the uneroded soils, and they are severe hazards in the eroded areas. Frost heaving is not likely to damage the plantations, and competition from other plants is generally not a serious problem. Tree diseases also are not a serious problem, but occasionally gophers may cause local damage. The principal insect pests are insect larvae that feed on the roots of the trees.

Except for the limitations imposed by slope and occasional stoniness, there are practically no limitations to the use of equipment on these soils. Roads ought to be located on the contour or on the tops of ridges in the steeper areas, and they should be protected to keep water from concentrating.

On the soils that have slopes of less than 12 percent, the establishment and the survival of seedlings are limited by a severe hazard of drought and a slight hazard of competition from other plants. Wind erosion is a moderate hazard.

Limitations to the use of equipment for planting trees and harvesting timber are slight. The hazard of windthrow is moderate.

Norway pine, white pine, and jack pine are the species to favor in the stand. Norway pine and white pine are the most favorable trees for underplanting.

On the soils that have slopes of more than 12 percent, the establishment and the survival of seedlings are limited by a severe hazard of drought and a slight hazard of competition from other plants. Erosion is a severe hazard.

Limitations to the use of equipment for planting trees and harvesting timber are moderate to severe, and the hazard of windthrow is moderate.

Norway pine, white pine, and jack pine are the species to favor in the stand. Norway pine and white pine are suitable trees for underplanting.

WOODLAND SUITABILITY GROUP 5

The soils of this group are somewhat excessively drained, medium textured or moderately coarse textured, and shallow or moderately shallow over the underlying material. Their limited depth restricts the development of roots and limits the water-supplying capacity.

The vegetation on these soils consists of aspen, different kinds of oak, white pine, different kinds of hardwoods other than aspen and oak, and native grasses. Scrub oak, redcedar, grass, brush, and weeds grow in the eroded areas and on the drier sites. Saw logs and fuelwood are the principal woodland products.

Measurements of trees growing on these soils show a wide variation in the site index. The site index for oak ranges from 50 to 70, but differences between the south-facing and north-facing slopes could not be measured. It is believed that differences do exist but that they are masked by other factors. The measurements indicate that the upper parts of the slopes are less favorable to the growth of trees than the middle or lower parts. The average site index on the upper parts of the slopes is 56, as compared to 62 for the middle and lower parts. Measurements of plantations indicate that Norway pine should do well on these soils.

Species suggested for planting on uneroded soils on the lower parts of the slopes are white pine, Norway pine, and white spruce. Jack pine and Norway pine are suggested for the steeper slopes and for eroded areas.

Stands of oaks regenerate naturally on these soils. The factors that limit regeneration on the poorest sites are heat and drought. In areas where the population of rabbits and meadow mice is large, those animals may limit the establishment of seedlings. White grubs are also troublesome in certain areas because they feed on the roots of trees. Encroaching brush should be controlled so that it will not overtop the favored species.

In some places gullies and stones on the lower slopes limit the use of machinery for planting trees. They severely limit the use of machinery on the steeper slopes.

Activities needed to control fires or to harvest timber are made difficult in some places because access to the areas is limited. Harvesting timber when the soils are dry or frozen helps to avoid soil compaction and erosion. Generally, roads are difficult to lay out and construct on the steeper slopes. Where feasible, roads should be built along ridge lines.

On the soils that have slopes of less than 12 percent, the establishment and the survival of seedlings are limited by moderate hazards of drought and competition from other plants and also by a slight hazard of wetness. The hazard of erosion is slight.

Limitations to the use of equipment for planting trees are slight, and limitations to the use of equipment for harvesting timber are moderate. The hazard of windthrow is slight.

Pine, red oak, sugar maple, and basswood are the species to favor in the present stands. White pine, Norway pine, and white spruce are suitable trees for planting.

On the soils that have slopes steeper than 12 percent, the establishment and the survival of seedlings are limited by a moderate hazard of drought, a moderate to severe hazard of competition from other plants, and a slight hazard of wetness. Erosion is a moderate to severe hazard. Limitations to the use of equipment for planting trees and harvesting timber are moderate to severe. The hazard of windthrow is slight.

Red oak and pine are the species to favor in the present stands. Norway pine is suitable for planting.

WOODLAND SUITABILITY GROUP 7

The soils of this group are medium textured to fine textured. They are somewhat poorly drained to very poorly drained.

The native vegetation on these soils was mainly aspen and mixed hardwoods. The principal woodland products are saw timber and fuelwood.

The quality of the site is generally medium for aspen and mixed hardwoods, medium for white pine, and good for balsam fir and white spruce.

Many hazards limit the establishment and growth of trees on these soils. The hazard of drowning is moderate to severe. Surface drainage is needed in stands of young trees and in areas to be planted, but it may not be economically feasible. Competition from grasses, sedges, and brush is severe.

Blister rust is a serious hazard to white pine growing on these soils if gooseberries and currants are nearby. Root rot is common, and it constitutes a major hazard. In some areas rabbits and deer can cause serious damage to trees, especially to trees in new plantations. The hazard of windthrow is severe. Therefore, only mature and defective trees should be removed when an area is logged, and a wind barrier should be left around the borders of the stand. Heat and drought are not likely to damage the trees, but frost is a hazard in some depressions.

Using machinery to plant trees, harvest timber, and control fires is difficult. Logging ought to be done only in winter or in dry seasons. In other seasons the soils are wet, equipment is likely to bog down, and serious soil compaction may result. In most places erosion is not a hazard, but stones interfere with planting in some places.

On these soils white pine, maple, and red oak are the

species to favor in the natural stands. White spruce, white pine, and white-cedar are the preferred species for planting. The trees ought to be planted on mounds or ridges, and they should not be planted in pockets where the soil material is shallow. A stand of timber, once gone, is difficult to reestablish on these soils.

The establishment and the survival of seedlings are limited by a slight hazard of drought, a severe hazard of competition from other plants, and a moderate hazard of wetness. Erosion is a slight hazard.

Limitations to the use of equipment for planting trees and harvesting timber are moderate to severe, and there is a moderate to severe hazard of windthrow.

White pine, maple, and red oak are the species to favor in the present stands. White spruce, white pine, and white-cedar are suitable for planting.

WOODLAND SUITABILITY GROUP 9

This group consists of somewhat poorly drained to very poorly drained soils formed in alluvium under a cover of trees. The principal native species on these soils are river birch, elm, cottonwood, and willow. Saw logs are the main wood product harvested.

The site quality for hardwoods on these soils ranges from poor to good. Cottonwood grows well on the somewhat poorly drained soils.

The likelihood of damage from heat, drought, or frost is slight on these soils. The hazard of drowning is rated as severe because of frequent flooding. Competition from other plants is severe because tall weeds and brush encroach in the openings. Normally, there is little risk of damage by insects, but damage from root rot and stem rot are moderate to severe hazards. Dams made by beaver can cause serious economic losses by flooding the forest stand, but they are not a serious problem at the present time. The hazard of windthrow is generally moderate, but it is severe if the water table is high for a long period.

Erosion is a hazard only along the banks of streams, but it can occasionally be severe. Use of machinery for planting trees can be hazardous on the somewhat poorly drained soils, and it is not practical on the poorly drained sites.

Cottonwood is the only species suggested for these soils, except that willow may be used to protect the streambanks. Timber should be harvested only when the soils are dry or frozen. When logging is done, the original cover of hardwoods should be maintained. Access to areas of these soils for the purpose of controlling fires is generally difficult, but fires are infrequent.

On these soils the establishment and the survival of seedlings are limited by a slight hazard of drought, a severe hazard of competition from other plants, and a moderate to severe hazard of wetness. Erosion is a moderate hazard on the streambanks.

Limitations to the use of equipment for planting trees are moderate to severe, and limitations to the use of equipment for harvesting timber are moderate. The hazard of windthrow is moderate.

The trees now growing in the stand should be favored. Cottonwood is suitable for planting.

WOODLAND SUITABILITY GROUP 10

Adrian muck is the only soil in this group. It is a very poorly drained organic soil consisting of muck and peat.

The natural vegetation on this soil is mainly willows and sedges. Pulpwood is the only forest product of any consequence that can be harvested. The site quality ranges from poor to good, depending on variations in drainage caused by differences in the microrelief.

Frosts late in spring are common on this soil, and they cause serious mortality of seedlings. The water table fluctuates, and the high water may drown many of the tree seedlings. The hazard of windthrow is severe. Therefore, cutting should be limited. Using machines to plant trees is impractical, and hand planting is difficult. If this soil is cleared for agricultural use, wind erosion is a hazard. Willows may be planted to control erosion in those areas.

WOODLAND SUITABILITY GROUP 11

Riverwash, a miscellaneous land type, makes up this group. It is unsuitable for trees or has only limited suitability for them. The native vegetation is limited to miscellaneous small shrubs, grasses, and scattered small trees. Several hazards limit the establishment and survival of seedlings, and Riverwash is generally unsuitable for the production of wood products. Use for wildlife and protection of the watershed should be the primary considerations in any use or treatment of the areas. All management practices ought to be aimed at maintaining the present cover. Willows can be planted for the control of streambank erosion.

WOODLAND SUITABILITY GROUP 12

This group consists of medium-textured soils that form under prairie. These soils are well drained to very poorly drained.

The native vegetation on these soils consists of plants common to the prairie or of plants growing in oak openings. On these soils no forest products of commercial importance are harvested, although some fuelwood and fence posts may be cut. Bur oak and redcedar are the principal trees, and the quality of the site is rated as poor for all species.

Except that trees are sometimes planted for windbreaks, prairie soils are generally not used for trees. Species suitable for windbreak plantings on the well-drained soils are white pine, white-cedar, Norway spruce, European larch, and redcedar. On the poorly drained soils, the preferred species are white spruce, white-cedar, cottonwood, and willow.

Trees that are planted need to be cultivated for the first 2 or 3 years to reduce the hazard of competition from weeds and grasses and the hazard of damage from mice. White grubs are also likely to cause damage. Using an insecticide to control them may be necessary.

On the soils that are moderately well drained or well drained, slight hazards of drought and wetness and a severe hazard of competition from other plants limit the establishment and survival of seedlings. The hazard of erosion is slight.

Limitations to the use of equipment for planting trees are slight. Timber is generally not harvested on these soils. Windthrow is a slight hazard.

Normally, trees do not grow on these soils. If trees are planted for windbreaks, the species to favor are white pine and white spruce.

On the soils that are somewhat poorly drained to very poorly drained, a slight hazard of drought, a moderate hazard of competition from other plants, and a severe hazard of wetness limit the establishment and survival of seedlings. Erosion is a slight hazard.

Limitations to the use of equipment for planting trees is severe. Timber is generally not harvested on these soils. The hazard of windthrow is moderate.

Normally, trees do not grow on these soils. If trees are planted for windbreaks, white spruce, white-cedar, cottonwood, and willow are the species to favor.

Yield information

The estimated potential annual acre yields of usable timber from hardwoods and conifers on the soils and land types of Pierce County are given in table 2. The yields are expressed as gross board feet (Scribner rule). The estimates are for intensively managed, fully stocked stands in which there are enough trees to fully utilize the site. No deduction is made for cull timber or deficits. The yields shown are for trees harvested at the optimum age, and they are intended to show the maximum potential yields under the current concept of good management. Because of losses from seedling mortality and improper stocking, wild or unmanaged stands rarely attain the yields shown.

Engineering Uses of the Soils[3]

Some properties of soils are of special interest to engineers because they affect the construction and maintenance of roads, airports, and pipelines, the foundations of buildings, facilities for storing water, structures for controlling erosion, drainage systems, and systems for disposing of sewage. The properties most important to the engineer are permeability to water, shear strength, compaction characteristics, soil drainage, shrink-swell characteristics, grain size, plasticity, and soil reaction (pH). Also important are topography and depth to the water table or to bedrock. Some of the soil properties important to engineering are described in this section.

The information in this soil survey can be used with the soil survey maps and with other information in the survey to—

1. Make soil and land use studies that will aid in selecting and developing sites for industries, businesses, residences, and recreational purposes.
2. Make preliminary estimates of the engineering properties of soils in the planning of agricultural drainage systems, farm ponds, irrigation systems, and diversion terraces.
3. Make preliminary evaluations of soil and ground conditions that will aid in selecting locations for highways, airports, pipelines, and cables and in planning detailed investigations at the selected locations.
4. Locate probable sources of gravel and other construction material.
5. Correlate performance of engineering structures with soil types to develop information for overall planning that will be useful in designing and maintaining certain engineering practices and structures.
6. Determine the suitability of soil types for cross-country movement of vehicles and construction equipment.
7. Supplement the information obtained from other published maps and reports, and aerial photographs, to make maps and reports that can be used readily by engineers.
8. Develop other preliminary estimates for construction purposes pertinent to the particular area.

Used with the soil map to identify the soils, the engineering interpretations in this section can be useful for many purposes. It should be emphasized that the interpretations may not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads or where the excavations are deeper than the depths of the layers here reported. Furthermore, engineers and others should not apply specific values to the estimated values given for bearing capacity of soils. Nevertheless, even in such situations, the soil map is useful for planning more detailed field investigations and for suggesting the kinds of problems that can be expected.

Some of the terms used by the soil scientists may be unfamiliar to the engineer, and some words may have special meanings in soil science. These and other special terms are defined in the Glossary at the back of this soil survey.

Engineering classification systems

The U.S. Department of Agriculture (USDA) system of classifying soil texture is used by agricultural scientists. In this system the textural class of a soil is based on the proportions of sand, silt, and clay in the soil (*6*).[4] In some ways this system of classifying soils is comparable to the systems engineers use in classifying soils. The systems used by engineers are explained briefly in the paragraphs that follow.

Most highway engineers classify soil materials in accordance with the system approved by the American Association of State Highway Officials (AASHO) (*1*). In this system soil materials are classified in seven principal groups based on the gradation, liquid limit, and plasticity index of the soils. The groups are designated as A–1 through A–7. The best soils for subgrades, gravelly soils of high bearing capacity, are classified as A–1; the next best, A–2; and so on to the poorest, A–7, which are clay soils having low strength when wet. Within each group, the relative engineering value of the soil material is indicated by a group index number. Group index numbers range from 0 for the best material to 20 for the poorest.

[3] Prepared in cooperation with the State Highway Commission of Wisconsin, Bureau of Public Roads, and Soil Survey Division of Wisconsin Geologic and Natural History Survey.

[4] Italic numbers in parentheses refer to Literature Cited, p. 164.

TABLE 2.—*Estimated potential annual yields per acre of wood products from well-managed densely stocked stands in which the trees have grown to maximum harvest age.*

[Dashes indicate that trees do not grow on the soil or that the soil is not suited to the species indicated; timber that measures 50 board feet or less is generally harvested for cordwood because the size and quality of the timber preclude use of the trees for saw logs; 1 cord equals about 500 board feet; yields are expressed as gross board feet (Scribner rule). Soils omitted from this table have very severe limitations for growth of merchantable timber]

Soil	Cool sites [1]		Hot sites [2]	
	Hardwoods	Conifers	Hardwoods	Conifers
	Bd. ft.	*Bd. ft.*	*Bd. ft.*	*Bd. ft.*
Alluvial land, loamy	150	---	---	---
Alluvial land, sandy	100	---	---	---
Alluvial land, wet	150	---	---	---
Almena silt loam	175	500	---	---
Antigo silt loam	225	600	---	---
Arenzville silt loam	275	300	---	---
Arland loam	150	450	---	---
Auburndale silt loam	125	300	---	---
Boone loamy fine sand	50	300	50	300
Boone fine sand	50	300	50	300
Burkhardt sandy loam	---	450	---	---
Chaseburg silt loam	250	---	---	---
Chetek sandy loam	75	450	---	---
Dakota sandy loam	---	500	---	---
Derinda silt loam	175	---	125	---
Derinda silt loam, acid variant	100	---	100	---
Dickinson fine sandy loam	75	500	---	---
Downs silt loam	200	---	---	---
Dubuque silt loam	175	500	150	450
Dubuque soils	125	400	100	350
Dunbarton silt loam	100	---	75	---
Dunbarton complex	100	300	50	200
Fayette silt loam, benches	250	600	---	---
Freeon silt loam	200	500	---	---
Freer silt loam	185	400	---	---
Gale silt loam	185	500	125	400
Gale silt loam, thin solum variant	125	400	---	---
Halder loam	150	450	---	---
Halder loam, sandy substratum	150	450	---	---
Hesch fine sandy loam, loamy substratum	75	500	---	400
Hesch loam, loamy substratum	---	---	---	---
Hixton fine sandy loam	75	500	50	400
Hixton fine sandy loam, loamy substratum	150	500	---	400
Hixton loam, loamy substratum	175	500	---	400
Lamont very fine sandy loam	100	500	---	400
Meridian loam	150	500	---	---
Onamia loam	200	500	---	---
Onamia sandy loam	100	500	---	---
Orion silt loam	150	---	---	---
Otterholt silt loam	230	550	---	---
Plainfield loamy sand	---	500	---	---
Racine silt loam	200	500	---	---
Renova fine sandy loam, sandy variant	175	600	---	---
Renova silt loam	200	600	---	---
Rozetta silt loam, benches	250	500	---	---
Santiago silt loam	230	600	---	---
Sargeant silt loam	150	500	---	---
Seaton silt loam	275	600	275	600
Sparta loamy sand	---	450	---	---
Spencer silt loam	225	450	---	---
Stronghurst silt loam, benches	200	500	---	---
Tell silt loam	175	500	---	---
Terrace escarpments, loamy	175	500	---	400
Terrace escarpments, sandy	100	400	50	---
Vlasaty silt loam	200	500	---	---
Whalan silt loam	175	400	125	300
Wykoff loam	100	300	50	200
Wykoff silt loam	100	300	50	200

[1] North- and east-facing slopes, coves, and narrow valleys protected from heat and from drying winds.

[2] South- and west-facing slopes and exposed ridgetops, where the soils are exposed to high temperatures and drying winds.

For the soils tested, the group index number is shown in parentheses after the soil group symbol in table 3.

In the Unified system soils are identified on the basis of texture and plasticity and on their performance as material for engineering construction (*8*). The soil materials are identified as coarse grained, eight classes; fine grained, six classes; and highly organic, one class. The last column of table 3 gives the classification of the tested soils according to the Unified system.

Soil engineering data and interpretations

Soil engineering data and interpretations for engineering uses are given in tables 3, 4, and 5. Table 3 contains engineering test data for representative soils of Pierce County. The data given in this table are the results of tests made by the State Highway Commission of Wisconsin under a cooperative agreement with the U.S. Department of Commerce, Bureau of Public Roads. Tests were performed in accordance with standard AASHO procedures. The soil samples represented in table 3 were taken from major horizons of representative soils. In some profiles not all the major horizons were sampled.

Table 4 gives estimated properties of the soils of Pierce County. The information is based on test data in table 3 and on test data from similar soils in other counties. Where test data were not available, estimates were based on comparison with soils of like material that have been tested, and by study of the soils in the field. The soils of the Adrian series and Alluvial lands, Riverwash, and Steep stony and rocky land are not listed in the table. These soils are land types that are too variable in characteristics to be rated or that are otherwise not suitable for engineering uses.

The estimates in table 4 are for the soils as they occur in their natural state and not for areas that have been altered by cut and fill operations. Descriptions of the soil profiles are given in the sections "Descriptions of the Soils" and "Detailed Descriptions of Soil Series."

In table 4 the respective USDA, Unified, and AASHO classifications are shown. Also shown for each major horizon are the estimated percentages of material passing through the various sieves. The figures showing percentages have been rounded to the nearest 5 percent.

In the column showing permeability, the rate at which water moves through a saturated soil horizon is estimated. The ratings are given in inches per hour. Permeability is determined largely by texture, structure, and consistence. The rate of permeability for a soil profile is generally determined by the least permeable layer in the profile.

The estimated available water capacity is given in inches per inch of soil for the major soil horizons. Available water capacity refers to the amount of water that can be stored in the soil for the use of plants. For medium-textured and fine-textured soils, the estimated values are based on the differences in the amount of moisture retained at one-third and at 15 atmospheres of moisture tension. For sandy soils, the estimated values are based on the differences between the amounts of moisture retained at one-tenth and at 15 atmospheres of moisture tension.

The column showing reaction indicates the estimated acidity or alkalinity of the soils and is expressed as the pH value. A pH value of 7 indicates a neutral soil, a pH value lower than 7 indicates acidity, and a pH value higher than 7 indicates alkalinity. A knowledge of the pH values of soil horizons is helpful in determining the need for liming and for determining the hazard of corrosion for metal conduits and the risk of deterioration of concrete tile.

Shrink-swell potential refers to the change in volume of the soil material that results from a change in content of moisture. It is based on tests of volume change or on observance of other physical properties of the soils. The amount and kind of clay and the content of organic matter in the soils affect the shrink-swell potential. Soils in which illite clays are predominant, for example, have a lower shrink-swell ratio than soils in which montmorillonite clays are predominant.

Table 5 gives ratings of the suitability and also the limitations of the soils of the county for specific engineering purposes. It also names characteristics that affect the selection of a site, the design of a structure, or the application of measures to make the soils suitable for construction. A rating of *slight* means that the soil has no limitations or that it has slight limitations that are easily overcome. A rating of *moderate* means that the soil has limitations that can be overcome by good management and manipulation of the soil material. A rating of *severe* means that suitability for use is questionable and that the limitations are difficult to overcome. A rating of *very severe* means that use of the soil for the purpose named is generally considered unsound.

The ratings given soils as a source of topsoil or as a source of sand and gravel are "*good*," "*fair*," "*poor*," and "*very poor*." These ratings, in general, coincide with the ratings for limitations of *slight*, *moderate*, *severe*, and *very severe*, respectively. The suitability of soils as a source of topsoil refers specifically to the use of soil material as a topdressing for the banks of roads, parks, gardens, and lawns.

The subsoil of soils in certain parts of the county should be appraised as a possible source of topsoil. For example in the area of broad sand plains between Bay City and Diamond Bluff, loamy soil material is in great demand for topdressing lawns and road banks. In such places an isolated area of medium-textured loessal soils, such as the Seaton, might have part of the subsoil stripped off, as well as the uppermost few inches of soil material in the surface layer. This loamy subsoil material, if properly treated with fertilizer and amendments, would serve adequately as topsoil.

Table 5 indicates places where sand or gravel is generally within 5 feet of the surface. Some of the coarse-textured material contains an appreciable amount of finer textured material. For making determinations about the suitability of this material as a source of sand or gravel, it is necessary to dig individual test pits and to test samples in the laboratory.

Ratings of the limitations of the soils as a source of material to be used as subgrade for highways and as a support for foundations of low buildings are based mainly on interpretations of soil test data for representative soils. The surface soil generally is not used as material for subgrade, because of its relatively high content of organic matter. The degree to which material for subgrade is influenced by surface drainage, depth to which frost penetrates, and other such factors should be determined for each site from reliable local information.

The limitations of an undisturbed soil when used as a base for low buildings depend primarily on the bearing capacity and shrink-swell behavior of that soil. Slope and erosion are local factors and were not taken into account in determining the ratings given in table 5. The base of every part of the foundation should be placed, if feasible, below the depth to which the soil is subject to seasonal volume change caused by alternate wetting and drying. It should also be placed below the depth to which the soil structure is significantly weakened by root holes and animal burrows. Furthermore, in a cool, humid climate like that of Pierce County, the depth at which the foundation is placed is determined by the level to which the soil is affected by frost heaving. Therefore, it is the material in the substratum that provides the base for building foundations, and it is that material that is evaluated in table 5.

Limitations of the soils for disposing of effluent from septic tanks indicate the ability of the soil material to absorb and dispose of effluent without contaminating the surrounding areas. For those soils that have severe limitations, an on-site investigation and appropriate tests are necessary before determination can be made as to whether a soil is suitable. Soils that have very severe limitations are generally not considered suitable as filter fields for septic tanks used for domestic purposes. Suitability for filter fields and suitability for seepage beds are the main considerations in the ratings given, but limitations for seepage pits are also considered. A shallow seepage pit may prove satisfactory if the soil material is coarse textured, deep, and free draining. A deep pit may be needed,

TABLE 3.—*Engineering test data for*

[Tests performed by the State Highway Commission of Wisconsin in cooperation with the U.S. Department of Commerce, Bureau of

Soil name and location	Parent material	Depth	Horizon	Moisture density [1]	
				Maximum dry density	Optimum moisture content
		Inches		*Lb. per cu. ft.*	*Pct.*
Otterholt silt loam:					
SE¼NW¼ sec. 10, T. 27 N., R. 15 W. (Modal profile)	Thick loess over sandy loam glacial till.	19–27	B2	113. 6	15. 9
		36–48	C	131. 3	8. 6
NE¼NW¼ sec. 7, T. 25 N., R. 15 W. (Loam substratum)	Thick loess over loam glacial till.	23–33	B2	115. 4	15. 7
		43–53	C	130. 0	7. 6
NE¼SW¼ sec. 35, T. 26 N., R. 15 W. (Loam substratum)	Thick loess over loam glacial till.	22–32	B2		
		48–59	C		
Renova silt loam: [5]					
Central part of SW¼ sec. 25, T. 27 N., R. 19 W.	Loess over clay loam till	0–8	Ap	109	15
		16–24	B2	126	10
		30–60	C	127	10
Seaton silt loam:					
SE¼SW¼ sec. 26, T. 27 N., R. 15 W. (Modal profile).	Coarse-textured silt.	23–31	B2	115. 8	15. 0
		31–39	C	115. 6	14. 6
SE¼NW¼ sec. 14, T. 26 N., R. 15 W.	Coarse-textured silt.	23–33	B2		
		44–58	C		

[1] Based on AASHO Designation: T 99–57, Method A (*1*).
[2] According to AASHO Designation T 88–57 (*1*). Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 mm. in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 mm. in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soils.

TABLE 4.—*Engineering classifications of the soils of*

[Soils and land types that are too variable in characteristics to be classified are not included in this table. Soils and land types not included a determination would not be

Soil name	Depth from surface [1]	Classification		
		USDA texture	Unified	AASHO
	Inches			
Almena silt loam (AmA, AmB, AmB2).	0–12	Silt loam	ML	A–4
	12–45	Silty clay loam	CL	A–7
	45–60	Sandy loam	SC	A–2
Antigo silt loam (AnA, AnB, AnB2).	0–12	Silt loam	ML	A–4
	12–28	Silt loam	CL	A–6
	28–60	Sand and gravel	SP–SM	A–3
Arenzville silt loam (Ar).	0–20	Silt loam	ML–CL	A–4
	20–40	Silt loam	ML	A–7
	40–60	Silt loam	ML	A–4
Arland loam (AsB, AsC2).	0–12	Loam	ML	A–4
	12–30	Loam	ML	A–4
	30–60	Sand	SP–SM	A–3
Auburndale silt loam (Au).	0–8	Silt loam	ML	A–4
	8–26	Silt loam	CL	A–7
	26–60	Sandy loam	SC	A–2

See footnotes at end of table.

representative soils, Pierce County, Wis.

Public Roads (BPR) in accordance with standard procedures of the American Association of State Highway Officials (AASHO)]

Mechanical analysis [2]									Liquid limit	Plasticity index	Classification	
Percentage passing sieve—					Percentage smaller than—						AASHO [3]	Unified [4]
¾ in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.				
--------	--------	--------	100	99	94	52	27	23	31	10	A-4(8)--------	ML-CL.
100	97	95	80	37	34	28	18	14	21	8	A-4(0)--------	SC.
--------	--------	--------	100	98	90	50	26	22	34	12	A-6(9)--------	ML-CL.
--------	--------	100	88	53	48	36	25	20	27	14	A-6(6)--------	CL.
--------	--------	--------	100	99	96	50	27	24	37	16	A-6(10)-------	CL.
--------	--------	100	86	54	47	34	22	17	27	11	A-6(4)--------	CL.
--------	--------	100	94	75	69	41	16	11	26	5	A-4(8)--------	ML-CL.
99	95	77	65	31	27	18	13	10	21	8	A-2-4(0)-----	SC.
98	92	88	72	30	26	19	14	11	22	8	A-2-4(0)-----	SC.
--------	--------	--------	100	97	94	41	21	18	29	8	A-4(8)--------	ML-CL.
--------	--------	--------	100	98	94	42	21	17	31	10	A-4(8)--------	ML-CL.
--------	--------	--------	100	99	89	54	26	23	36	13	A-6(9)--------	ML-CL.
--------	--------	--------	100	99	88	50	24	20	34	13	A-6(9)--------	CL.

[3] Based on AASHO Designation: M 145-49 (*1*).

[4] Based on the Unified soil classification system (*8*). SCS and BPR have agreed that all soils having plasticity indexes within two points from A-line are to be given a borderline classification, for example, ML-CL.

[5] For the layer between a depth of 16 and 24 inches (B2 horizon), 100 percent of the soil material passed a 1½-inch sieve, and for the layer between a depth of 30 and 60 inches (C horizon), 100 percent of the soil material passed a 2-inch sieve.

Pierce County and their estimated properties

are the Adrian (Ad), Alluvial lands (Ae, Ag, Ah, Al), Riverwash (Rh), and Steep stony and rocky land (StF). Dashes indicate that applicable or that it was not made]

Percentage passing sieve [2]—			Permeability	Available water capacity	Reaction	Shrink-swell potential
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.07 mm.)				
			Inches per hour	*Inches per inch of soil depth*	*pH value*	
100	100	100	0. 8-2. 5	0. 22	5. 6-6. 5	Moderate.
100	100	90	0. 8-2. 5	. 20	4. 5-5. 0	Moderate.
85	80	30	0. 2-0. 8	. 08	4. 5-5. 0	Moderate.
100	100	95	0. 8-2. 5	. 22	[3] 6. 1-7. 3	Moderate.
100	100	85	0. 8-2. 5	. 20	6. 1-6. 5	Moderate.
85	80	5	([4])	. 02	5. 6-6. 5	Very low.
100	100	95	0. 8-2. 5	. 22	7. 4-7. 8	Moderate.
100	100	95	0. 8-2. 5	. 20	7. 4-7. 8	Moderate.
100	100	95	0. 2-0. 8	. 20	6. 6-7. 3	Moderate.
90	85	55	0. 8-2. 5	. 16	5. 6-6. 0	Moderate.
90	85	55	0. 8-2. 5	. 14	5. 6-6. 5	Moderate.
90	90	5	5. 0-10. 0	. 04	5. 6-6. 0	Very low.
100	100	100	0. 8-2. 5	. 22	5. 1-6. 5	Moderate.
100	100	90	0. 8-2. 5	. 20	4. 6-5. 5	Moderate.
85	80	30	0. 2-0. 8	. 08	6. 1-7. 3	Moderate.

TABLE 4.—*Engineering classifications of the soils of Pierce*

Soil name	Depth from surface [1]	Classification		
		USDA texture	Unified	AASHO
	Inches			
Boone loamy fine sand (BnB2, BnC2).	0–18	Loamy fine sand	SP–SM	A–2
	18–60	Fine sand	SP–SM	A–3
Boone fine sand (BfE2).	0–60	Fine sand	SP–SM	A–3
Burkhardt loam (BrA).	0–10	Loam	ML–CL	A–4
	10–20	Gravelly loam	SM–SC	A–2
	20–60	Sand and gravel	SP	A–1
Burkhardt sandy loam (BuA, BuB).	0–10	Sandy loam	SM	A–2
	10–20	Gravelly loam	SM–SC	A–2
	: 20	Sand and gravel	SP	A–1
Chaseburg silt loam (CaA, CaB).	0–24	Silt loam	ML	A–4
	24–60	Silt loam	ML–CL	A–4
Chetek sandy loam (ChB, ChD2).	0–10	Sandy loam	SM	A–2
	10–20	Loam	SM–SC	A–4
	20–60	Sand and gravel	SP	A–1
Clyde silt loam (Cl).	0–12	Silt loam	ML–CL	A–7
	12–36	Silty clay loam	CL	A–7
	36–60	Gravelly loam	SM	A–4
Dakota loam (DaA, DaB, DaC2).	0–12	Loam	ML–CL	A–4
	12–36	Loam	SC	A–4
	36–60	Sand	SP	A–3
Dakota loam, rock substratum (DcA, DcB2).	0–12	Loam	ML–CL	A–4
	12–36	Loam	CL	A–4
	36	Dolomite		
Dakota loam, loamy substratum (DbA, DbB).	0–12	Loam	ML–CL	A–4
	12–36	Loam	SC	A–4
	36–60	Loam	CL	A–6
Dakota sandy loam (DdA, DdB).	0–12	Sandy loam	SM	A–2
	12–30	Loam	SC	A–4
	30–60	Sand	SP	A–3
Derinda silt loam (DeA, DeB, DeB2, DeC, DeC2, DeD, DeD2, DeE).	0–10	Silt loam	ML–CL	A–4
	10–30	Silty clay	CL	A–7
	30–60	Shale	CL	A–6
Derinda silt loam, acid variant (DfC2, DfD2).	0–10	Silt loam	ML–CL	A–4
	10–30	Silty clay	CL	A–7
	30–60	Shale	CL	A–6
Dickinson fine sandy loam (DkB2).	0–29	Very fine sandy loam	SM–SC	A–4
	29–34	Loam	ML	A–4
	34–60	Very fine sandy loam	SM–SC	A–4
Downs silt loam (DoB, DoB2, DoC2).	0–12	Silt loam	ML–CL	A–4
	12–40	Silty clay loam	ML–CL	A–6
	40–60	Silt loam	ML–CL	A–6
Dubuque silt loam (DsA, DsB, DsB2, DsC, DsC2, DsD, DsD2, DsE, DsE2, DsF, DtB3, DtC3, DtD3).	0–12	Silt loam	ML–CL	A–4
	12–36	Silty clay loam	ML–CL	A–6
	36–50	Clay	MH–CH	A–7
	50	Dolomite		
Dunbarton silt loam (DuB, DuB2, DuC, DuC2, DuD, DuD2, DuE, DuE2, DvC, DvC2, DvD, DvD2, DvE, DvE2).	0–12	Silt loam	ML–CL	A–5
	12–15	Silty clay loam	ML–CL	A–6
	15–20	Clay	MH–CH	A–7
	20	Dolomite		
Edith soils (EdC2, EdD, EdD2, EdE).	0–10	(5)		
	10–60	Gravelly loamy sand	SM	A–1

See footnotes at end of table.

County and their estimated properties—Continued

Percentage passing sieve [2]—			Permeability	Available water capacity	Reaction	Shrink-swell potential
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.07 mm.)				
			Inches per hour	*Inches per inch of soil depth*	*pH value*	
100	60	15	5. 0–10. 0	. 08	[3] 6. 1–7. 3	Very low.
95	55	5	[4]	. 06	5. 6–6. 0	Very low.
100	90	15	[4]	. 04	[3] 6. 1–7. 3	Very low.
100	85	55	0. 8–2. 5	. 20	5. 6–6. 0	Low.
85	60	45	5. 0–10. 0	. 10	5. 6–6. 0	Moderate.
65	45	5	[4]	. 02	6. 1–6. 5	Very low.
90	65	30	2. 5–5. 0	. 10	5. 6–6. 0	Low.
85	60	45	5. 0–10. 0	. 10	5. 6–6. 0	Moderate.
65	45	5	[4]	. 02	6. 1–6. 5	Very low.
100	95	90	0. 8–2. 5	. 20	[3] 6. 1–7. 3	Moderate.
100	95	90	0. 2–0. 8	. 18	5. 6–6. 5	Moderate.
95	65	30	2. 5–5. 0	. 08	5. 6–6. 5	Low.
90	65	45	5. 0–10. 0	. 12	6. 1–6. 5	Moderate.
65	45	5	[4]	. 02	6. 1–6. 5	Very low.
100	95	90	0. 2–0. 8	. 24	6. 6–7. 8	Moderate.
95	95	90	0. 2–0. 8	. 20	6. 6–7. 3	High.
75	65	45	0. 2–0. 8	. 10	6. 6–7. 4	Low.
100	85	55	0. 8–2. 5	. 20	6. 1–7. 3	Low.
100	90	45	0. 8–2. 5	. 14	5. 1–6. 5	Moderate.
95	95	5	5. 0–10. 0	. 04	5. 6–7. 0	Very low.
100	85	55	0. 8–2. 5	. 20	[3] 6. 1–7. 3	Low.
100	90	55	0. 8–2. 5	. 14	5. 1–6. 5	Moderate.
----------	----------	----------	[5]	----------	----------	
100	85	55	0. 8–2. 5	. 20	[3] 6. 1–7. 3	Low.
100	90	45	0. 8–2. 5	. 14	5. 1–6. 5	Moderate.
90	80	55	0. 8–2. 5	. 14	5. 6–6. 0	Moderate.
100	100	30	2. 5–5. 0	. 16	[3] 6. 1–7. 3	Low.
100	90	45	2. 5–5. 0	. 12	5. 1–6. 5	Low.
95	95	5	5. 0–10. 0	. 04	5. 6–6. 0	Very low.
100	100	95	0. 8–2. 5	. 20	5. 1–6. 0	Moderate.
100	100	100	0. 2–0. 8	. 18	5. 1–5. 5	High.
90	90	85	[6]	. 12	6. 1 7. 8	High.
100	100	95	0. 8–2. 5	. 20	5. 6–6. 5	Moderate.
100	100	100	0. 2–0. 8	. 18	4. 6–5. 0	High.
90	90	85	[6]	. 12	3. 6–4. 5	High.
100	85	45	2. 5–5. 0	. 20	5. 6–6. 5	Low.
100	90	55	0. 5–5. 0	. 14	6. 1–6. 5	Moderate.
100	85	45	0. 8–2. 5	. 20	5. 6–6. 5	Low.
100	100	100	0. 8–2. 5	. 22	[3] 6. 1–7. 3	Moderate.
100	100	100	0. 8–2. 5	. 20	5. 1–6. 5	Moderate.
100	100	100	0. 2–0. 8	. 18	5. 1–6. 0	Moderate.
100	100	100	0. 8–2. 5	. 20	5. 6–6. 0	Moderate.
100	100	100	0. 2–0. 8	. 18	5. 1–5. 5	Moderate.
90	70	70	0. 05–0. 2	. 16	5. 6–7. 8	High.
----------	----------	----------	----------	----------	----------	----------
100	100	95	0. 8–2. 5	. 20	5. 6–6. 0	Moderate.
100	100	95	0. 2–0. 8	. 18	5. 6–6. 0	Moderate.
90	70	70	0. 5–0. 2	. 16	5. 6–6. 0	High.
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70	45	10	5. 0–10. 0	. 05	5. 6–7. 3	Very low.

TABLE 4.—*Engineering classifications of the soils of Pierce*

Soil name	Depth from surface [1]	Classification		
		USDA texture	Unified	AASHO
	Inches			
Edith-Wykoff soils (EwC2, EwD2, EwD3, EwE). (For Edith part, see Edith soils, and for Wykoff part, see Wykoff loam.)				
Fayette silt loam, benches (FaA, FaB, FaC2).	0–12	Silt loam	ML–CL	A–4
	12–40	Silty clay loam	CL	A–7
	40–60	Silt loam	ML–CL	A–7
Floyd silt loam (FlB).	0–12	Silt loam	ML–CL	A–7
	12–36	Silty clay loam	CL	A–7
	36–60	Loam	ML	A–4
Freeon silt loam (FnB2, FnC2).	0–12	Silt loam	ML	A–4
	12–30	Silt loam	CL	A–6
	30–60	Sandy loam to loam	SC	A–2
Freer silt loam (Fr).	0–12	Silt loam	ML	A–4
	12–30	Silt loam	CL	A–6
	30–60	Sandy loam to loam	SC	A–2
Gale silt loam (GaB, GaB2, GaC2, GaD2).	0–12	Silt loam	ML–CL	A–4
	12–30	Silty clay loam	CL	A–7
	30–60	Sand	SM–SP	A–3
Gale silt loam, thin solum variant (GtC2, GtD, GtD2, GtE).	0–10	Silt loam	ML–CL	A–4
	10–20	Silt loam	ML–CL	A–4
	20–60	Siltstone and sandstone		
Halder loam, sandy substratum (HdA).	0–12	Loam	ML	A–4
	12–30	Loam	ML–CL	A–4
	30–60	Sand	SM–SP	A–3
Halder loam (HaA).	0–12	Loam	CL	A–4
	12–30	Loam	CL	A–4
	30–60	Sand and gravel	SW	A–1
Hesch loam, loamy substratum (HlB, HlB2 HlC2, HlD2).	0–12	Loam	ML	A–4
	12–30	Loam	ML	A–4
	30–40	Sand	SP	A–3
	40–60	Loam	CL	A–6
Hesch fine sandy loam, loamy substratum (HeB2, HeC2, HeD2).	0–12	Fine sandy loam	SM	A–2
	12–30	Loam	SM	A–4
	30–40	Sand	SM–SP	A–3
	40–60	Loam	CL	A–6
Hixton loam, loamy substratum (HtB, HtC2, HtD2).	0–12	Loam	ML	A–4
	12–30	Loam	ML	A–4
	30–40	Sand	SM–SP	A–3
	40–60	Loam	CL	A–6
Hixton fine sandy loam (HmC2, HmD2).	0–12	Fine sandy loam	SM	A–2
	12–30	Loam	ML	A–4
	30–60	Sand	SM–SP	A–3
Hixton fine sandy loam, loamy substratum (HnB, HnB2, HnC, HnC2, HnD, HnD2, HnE).	0–12	Fine sandy loam	SM	A–2
	12–30	Loam	ML	A–4
	30–40	Sand	SM–SP	A–3
	40–60	Loam	CL	A–6
Lamont very fine sandy loam (LaB2, LaC2, LaD2).	0–12	Very fine sandy loam	ML	A–4
	12–30	Very fine sandy loam	ML	A–4
	30–60	Loamy very fine sand	SM	A–2
Lawler loam (LcA).	0–12	Loam	ML	A–4
	12–36	Loam	CL	A–4
	36–60	Sand	SP	A–3

See footnotes at end of table.

County and their estimated properties—Continued

Percentage passing sieve [2]— No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.07 mm.)	Permeability	Available water capacity	Reaction	Shrink-swell potential
			Inches per hour	*Inches per inch of soil depth*	*pH value*	
100	100	100	0. 8–2. 5	. 20	5. 6–6. 0	Moderate.
100	100	100	0. 8–2. 5	. 18	4. 6–5. 0	Moderate
100	100	100	0. 2–0. 8	. 18	4. 6–5. 0	Moderate.
100	100	100	0. 8–2. 5	. 24	[3] 6. 1–7. 3	Moderate.
100	100	95	0. 2–0. 8	. 20	5. 6–7. 3	High.
90	85	55	0. 2–0. 8	. 12	5. 6–6. 0	Moderate.
100	100	100	0. 8–2. 5	. 22	5. 6–6. 5	Moderate.
100	100	90	0. 2–0. 8	. 20	5. 1–5. 5	High.
90	85	30	0. 2–0. 8	. 08	5. 6–6. 0	Moderate.
100	100	100	0. 8–2. 5	. 22	4. 6–6. 5	Moderate.
100	100	95	0. 2–0. 8	. 20	5. 1–5. 5	Moderate.
90	85	30	0. 2–0. 8	. 08	5. 6–6. 0	Moderate.
100	100	100	0. 8–2. 5	. 20	[3] 5. 6–7. 3	Moderate.
100	100	95	0. 8–2. 5	. 18	4. 6–6. 0	High.
100	100	5	5. 0–10. 0	. 04	5. 1–5. 5	Very low.
100	100	100	0. 8–2. 5	. 20	5. 1–6. 5	Moderate.
100	100	100	0. 8–2. 5	. 20	5. 1–6. 0	Moderate.
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100	100	55	0. 8–2. 5	. 16	5. 1–6. 5	Moderate.
100	100	55	0. 8–2. 5	. 14	5. 1–6. 0	Moderate.
100	100	5	5. 0–10. 0	. 04	5. 1–6. 5	Very low.
90	75	55	0. 8–2. 5	. 16	[3] 6. 1–8. 4	Moderate.
90	75	60	0. 8–2. 5	. 14	5. 1–6. 0	Moderate.
65	35	5	([4])	. 02	5. 1–5. 5	Very low.
100	95	60	0. 8–2. 5	. 20	[3] 6. 1–7. 3	Moderate.
95	90	60	0. 8–2. 5	. 10	6. 1–6. 5	Moderate.
100	95	5	5. 0–10. 0	. 04	6. 1–6. 5	Very low.
90	80	55	0. 8–2. 5	. 14	6. 1–6. 5	Moderate.
100	90	30	2. 5–5. 0	. 14	[3] 6. 1–7. 3	Low.
100	95	55	0. 8–2. 5	. 10	6. 1–6. 5	Low.
100	95	5	5. 0–10. 0	. 04	6. 1–6. 5	Very low.
90	80	55	0. 8–2. 5	. 14	6. 1–6. 5	Moderate.
100	100	55	0. 8–2. 5	. 16	[3] 6. 1–7. 3	Moderate.
100	100	60	0. 8–2. 5	. 14	5. 6–7. 3	Moderate.
90	90	5	5. 0–10. 0	. 04	5. 6–6. 0	Very low.
90	80	55	0. 8–2. 5	. 14	5. 6–7. 3	Moderate.
100	90	30	2. 5–5. 0	. 14	[3] 6. 1–7. 3	Moderate.
100	100	40	0. 8–2. 5	. 14	5. 6–7. 3	Moderate.
100	100	5	5. 0–10. 0	. 04	5. 6–7. 3	Very low.
100	90	30	2. 5–5. 0	. 14	[3] 6. 1–7. 3	Moderate.
100	100	60	0. 8–2. 5	. 14	5. 6–7. 3	Moderate.
100	100	5	5. 0–10. 0	. 04	5. 6–6. 0	Very low.
90	80	55	0. 8–2. 5	. 14	5. 6–7. 3	Moderate.
100	85	55	2. 5–5. 0	. 20	5. 1–5. 5	Low.
100	85	55	2. 5–5. 0	. 20	5. 6–6. 0	Low.
100	60	15	2. 5–5. 0	. 08	5. 6–6. 0	Low.
100	85	55	0. 8–2. 5	. 20	[3] 6. 1–7. 3	Low.
100	90	55	0. 8–2. 5	. 14	5. 1–6. 5	Moderate.
95	95	5	5. 0–10. 0	. 04	7. 4–7. 8	Very low.

TABLE 4.—*Engineering classifications of the soils of Pierce*

Soil name	Depth from surface [1]	Classification		
		USDA texture	Unified	AASHO
	Inches			
Lawler silt loam (LwA, LwB).	0–12	Silt loam	ML–CL	A–6
	12–30	Clay loam	CL	A–6
	30–60	Sand	SP–SM	A–3
Meridian loam (MdA, MdB).	0–12	Loam	ML	A–4
	12–30	Loam	ML–CL	A–4
	30–60	Sand	SM–SP	A–3
Onamia loam (OmA, OmB, OmB2, OmC2, OmD2).	0–12	Loam	ML	A–4
	12–30	Loam	ML	A–4
	30–60	Sand and gravel	GW	A–1
Onamia sandy loam (OnB, OnC2).	0–12	Sandy loam	SM	A–2
	12–30	Loam	ML	A–4
	30–60	Sand and gravel	GW	A–1
Orion silt loam (Or).	0–10	Silt loam	ML	A–4
	10–40	Silt loam	ML	A–4
	40–60	Silt loam	ML	A–4
Ostrander silt loam (OsA, OsB, OsB2, OsC2).	0–12	Silt loam	ML–CL	A–6
	12–36	Loam	CL	A–6
	36–60	Loam	CL	A–6
Otterholt silt loam (OtB, OtB2, OtC, OtC2, OtC3, OtD2).	0–12	Silt loam	ML	A–4
	12–36	Silt loam	ML–CL	A–4
	36–60	Sandy loam	SM–SC	A–2
Plainfield loamy sand (PmA, PmB, PmB2, PmC, PmC2).	0–10	Loamy sand	SM–SP	A–2
	10–60	Sand	SP	A–3
Port Byron silt loam (PoA, PoB, PoC2).	0–12	Silt loam	ML	A–6
	12–36	Silt loam	ML–CL	A–6
	36–60	Silt loam	ML–CL	A–6
Racine silt loam (RaB, RaB2, RaC2).	0–12	Silt loam	ML–CL	A–6
	12–36	Silt loam	CL	A–6
	36–60	Loam	CL	A–6
Renova silt loam (ReA, ReB, ReB2, ReC, ReC2, ReC3, ReD, ReD2, ReD3).	0–12	Silt loam	ML–CL	A–4
	12–26	Loam	CL	A–6
	26–60	Clay loam	CL	A–6
Renova fine sandy loam, sandy variant (RfB2, RfC2, RfD2).	0–22	Fine sandy loam	SM	A–2
	22–30	Sandy clay loam	SC	A–6
	30–48	Clay loam	CL	A–6
	48–60	Dolomite		
Rockton complex (RoB, RoC2) (Rockton loam part).	0–32	Loam	ML–CL	A–4
	32–60	Dolomite		
Rozetta silt loam, benches (RtA, RtB).	0–12	Silt loam	ML–CL	A–4
	12–36	Silt loam	CL	A–7
	36–60	Silt and sand	CL	A–4
Sable silt loam (Sa).	0–12	Silt loam	ML–CL	A–4
	12–36	Silty clay loam	CL	A–7
	36–60	Silt loam	CL	A–6
Santiago silt loam (SbB, SbB2, SbC2).	0–10	Silt loam	ML–CL	A–4
	10–36	Silt loam	ML–CL	A–4
	36–60	Sandy loam	SC	A–2
Sargeant silt loam (SgA, SgB, SgB2, SgC, SgC2).	0–12	Silt loam	ML–CL	A–4
	12–36	Loam	CL	A–6
	36–60	Loam	CL	A–6

See footnotes at end of table.

County and their estimated properties—Continued

Percentage passing sieve [2]—			Permeability	Available water capacity	Reaction	Shrink-swell potential
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.07 mm.)				
			Inches per hour	*Inches per inch of soil depth*	*pH value*	
100	100	100	0. 8–2. 5	. 24	[3] 6. 1–7. 3	Moderate.
100	100	75	0. 8–2. 5	. 20	5. 1–6. 5	High.
100	100	5	5. 0–10. 0	. 04	7. 4–7. 8	Very low.
100	100	55	0. 8–2. 5	. 16	5. 1–6. 5	Moderate.
100	100	55	0. 8–2. 5	. 14	5. 1–5. 5	Moderate.
100	100	5	5. 0–10. 0	. 04	5. 6–6. 0	Very low.
95	90	55	0. 8–2. 5	. 16	5. 6–6. 5	Low.
95	90	60	0. 8–2. 5	. 10	5. 1–6. 5	Moderate.
40	30	5	([4])	. 02	5. 6–6. 0	Very low.
90	85	30	0. 8–2. 5	. 10	5. 6–6. 5	Low.
85	80	60	0. 8–2. 5	. 08	5. 1–6. 5	Moderate.
40	30	5	([4])	. 02	5. 6–6. 0	Very low.
100	100	100	0. 8–2. 5	. 20	[3] 6. 6–7. 3	Moderate.
100	100	100	0. 8–2. 5	. 18	6. 1–7. 3	Moderate.
100	100	95	0. 2–0. 8	. 18	6. 1–6. 5	Moderate.
100	100	75	0. 8–2. 5	. 22	[3] 6. 1–7. 3	Moderate.
100	100	65	0. 2–0. 8	. 18	6. 1–6. 5	Moderate.
100	100	65	0. 05–0. 2	. 16	5. 6–6. 0	Moderate.
100	100	100	0. 8–2. 5	. 22	5. 1–6. 5	Moderate.
100	100	100	0. 8–2. 5	. 20	4. 6–5. 5	Moderate.
95	95	30	0. 2–0. 8	. 10	4. 6–5. 5	Moderate.
100	100	15	5. 0–10. 0	. 07	[3] 6. 1–7. 3	Low.
100	95	5	([4])	. 04	6. 1–6. 5	Very low.
100	100	95	0. 8–2. 5	. 25	5. 6–7. 3	Moderate.
100	100	100	0. 8–2. 5	. 20	5. 6–6. 0	Moderate.
100	100	85	0. 2–0. 8	. 20	5. 6–6. 0	Moderate.
100	100	75	0. 8–2. 5	. 22	[3] 6. 1–7. 3	Moderate.
100	100	65	0. 8–2. 5	. 18	6. 1–6. 5	High.
100	100	65	0. 05–0. 2	. 16	5. 6–6. 0	High.
100	100	65	0. 8–2. 5	. 20	6. 1–6. 5	Moderate.
90	85	55	0. 8–2. 5	. 14	5. 1–6. 0	Moderate.
100	95	60	0. 05–0. 2	. 12	5. 6–6. 5	Moderate.
100	90	30	2. 5–5. 0	. 14	5. 6–6. 0	Moderate.
90	85	45	0. 2–0. 8	. 14	5. 1–5. 5	Moderate.
100	95	60	0. 05–0. 2	. 12	6. 1–6. 5	Moderate.
100	85	55	0. 8–2. 5 ([5])	. 20	6. 1–6. 5	Moderate.
100	100	100	0. 8–2. 5	. 20	5. 6–6. 0	Moderate.
100	100	100	0. 8–2. 5	. 18	5. 1–5. 5	High.
100	100	100	0. 8–2. 5	. 18	5. 1–5. 5	Moderate.
100	100	100	0. 8–2. 5	. 20	7. 4–8. 4	Moderate.
100	100	100	0. 2–0. 8	. 18	7. 4–7. 8	High.
100	100	100	0. 2–0. 8	. 18	8. 5–9. 0	Moderate.
100	100	90	0. 8–2. 5	. 22	5. 6–6. 5	Moderate.
100	95	80	0. 8–2. 5	. 20	4. 6–5. 5	Moderate.
95	90	30	0. 2–0. 8	. 08	5. 6–6. 0	Moderate.
100	100	65	0. 8–2. 5	. 20	4. 6–6. 5	Moderate.
90	85	55	0. 2–0. 8	. 14	4. 6–5. 5	Moderate.
100	95	55	0. 05–0. 2	. 12	4. 6–5. 5	Moderate.

TABLE 4.—*Engineering classifications of the soils of Pierce*

Soil name	Depth from surface [1]	Classification		
		USDA texture	Unified	AASHO
Schapville silt loam (ShC, ShC2, ShD2, ShE2).	0–12	Silt loam	ML–CL	A–6
	12–30	Silty clay loam	CL	A–7
	30–60	Shale residuum	CL	A–6
Schapville silt loam, wet subsoil variant (SkB2).	0–12	Silt loam	ML–CL	A–6
	12–30	Silty clay loam	CL	A–7
	30–60	Shale residuum	CL	A–6
Seaton silt loam (SnB, SnB2, SnC, SnC2, SnC3, SnD, SnD2, SnD3, SnE, SnE2).	0–12	Silt loam	ML	A–4
	12–40	Silt loam	ML–CL	A–4
	40–60	Silt and sand	ML–CL	A–4
Sogn-Rockton loams (SoA, SoB, SoC2, SoD2) (Sogn part).	0–10	Silt loam	ML–CL	A–7
	10	Dolomite		
Sparta loamy sand (SpA, SpB, SpB2, SpC2).	0–10	Loamy sand	SM–SP	A–2
	10–20	Sand	SM–SP	A–3
	20–60	Sand	SP	A–3
Spencer silt loam (SrA, SrB, SrB2, SrC2).	0–12	Silt loam	ML	A–4
	12–36	Silt loam	ML–CL	A–6
	36–60	Sandy loam	SC	A–2
Stronghurst silt loam, benches (SuA).	0–12	Silt loam	ML–CL	A–4
	12–36	Silty clay loam	CL	A–7
	36–60	Silty clay loam	CL	A–7
Tell silt loam (TeA, TeB2).	0–12	Silt loam	ML–CL	A–4
	12–30	Silty clay loam	CL	A–6
	30–60	Sand	SP	A–3
Terrace escarpments, loamy (Tl).	0–60	Silt loam and loam	ML–CL	A–4
Terrace escarpments, sandy (Ts).	0–60	Sandy loam and loamy sand	SM	A–2
Terril loam (Tx).	0–36	Loam	ML	A–4
	36–60	Silt and sand	ML–CL	A–4
Vlasaty silt loam (VaB, VaB2, VaC, VaC2).	0–12	Silt loam	ML–CL	A–4
	12–36	Clay loam	CL	A–6
	36–60	Clay loam	CL	A–6
Waukegan silt loam (WaA, WaB).	0–12	Silt loam	ML–CL	A–6
	12–30	Silty clay loam	CL	A–6
	30–60	Sand	SP–SM	A–3
Whalan silt loam (WhA, WhB, WhB2, WhC, WhC2, WhD, WhD2, WhD3, WhE, WhE2).	0–12	Silt loam	ML	A–4
	12–30	Loam	CL	A–6
	30–60	Dolomite		
Worthen silt loam (Wn).	0–20	Silt loam	ML–CL	A–6
	20–40	Silt loam	ML–CL	A–4
	40–60	Silt	ML–CL	A–4
Wykoff loam (WoB, WoB2, WoC, WoC2, WoC3, WoD, WoD2, WoD3).	0–12	Loam	ML	A–4
	12–24	Loam	CL	A–4
	24–60	Gravel and sand	SP	A–1
Wykoff silt loam (WsB, WsB2, WsC2).	0–18	Silt loam	ML	A–4
	18–24	Loam	CL	A–4
	24–60	Gravel and sand	SP	A–1

[1] Depths shown for horizons are generalized. They are not the same as those given in the profiles described as representative for the series.
[2] The figures shown are for average values; the values range from about 10 percent less to 10 percent more than the figures shown.
[3] The range in pH for the surface layer of these soils includes the pH in both limed and unlimed areas.

County and their estimated properties—Continued

Percentage passing sieve [2]— No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.07 mm.)	Permeability	Available water capacity	Reaction	Shrink-swell potential
100	100	100	0. 8–2. 5	. 24	5. 6–6. 0	Moderate.
100	100	100	0. 2–0. 8	. 20	5. 6–6. 0	High.
90	90	85	(6)	. 12	7. 4–7. 8	
100	100	100	0. 8–2. 5	. 24	[3] 6. 1–7. 3	Moderate.
100	100	100	0. 2–0. 8	. 20	5. 6–6. 5	High.
90	90	85	(6)	. 12	6. 6–8. 4	
100	100	100	0. 8–2. 5	. 22	6. 1–6. 5	Moderate.
100	100	95	0. 8–2. 5	. 20	4. 6–6. 0	Moderate.
100	100	100	0. 2–0. 8	. 18	5. 1–6. 5	Low.
95	95	80	0. 8–2. 5	. 24	5. 1–6. 5	Moderate.
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100	100	15	(4)	. 08	5. 6–6. 5	Low.
100	95	10	(4)	. 06	5. 6–6. 5	Very low.
95	90	5	(4)	. 04	4. 5–5. 5	Very low.
100	100	100	0. 8–2. 5	. 22	[3] 5. 6–7. 8	Moderate.
100	100	90	0. 8–2. 5	. 20	4. 6–6. 0	Moderate.
85	65	30	0. 8–2. 5	. 08	4. 6–6. 5	Moderate.
100	100	100	0. 8–2. 5	. 20	[3] 6. 1–7. 3	Moderate.
100	100	100	0. 2–0. 8	. 18	5. 1–6. 5	High.
100	100	100	0. 05–0. 2	. 16	5. 1–6. 0	High.
100	100	100	0. 8–2. 5	. 20	[3] 6. 1–7. 3	Moderate.
100	100	95	0. 8–2. 5	. 18	5. 1–6. 5	High.
100	100	5	5. 0–10. 0	. 04	5. 6–6. 0	Very low.
100	100	55–95	0. 8–2. 5	. 22	5. 6–6. 5	Moderate.
100	100	15–35	2. 5–10. 0	. 12	5. 6–6. 5	Low.
45	90	55	0. 8–2. 5	. 20	5. 6–6. 0	Moderate.
100	95	60	0. 8–2. 5	. 20	5. 6–6. 0	Low.
100	100	100	0. 8–2. 5	. 20	[3] 5. 6–6. 5	Moderate.
90	85	75	0. 8–2. 5	. 20	4. 6–5. 5	High.
95	90	55	0. 2–0. 8	. 18	5. 6–6. 0	High.
100	100	100	0. 8–2. 5	. 24	[3] 5. 6–7. 3	Moderate.
100	100	75	0. 8–2. 5	. 20	5. 6–6. 0	High.
100	100	5	5. 0–10. 0	. 04	5. 6–6. 0	Very low.
100	100	100	0. 8–2. 5	. 20	[3] 6. 1–7. 3	Moderate.
100	100	60	0. 8–2. 5	. 14	6. 1–7. 3	Moderate.
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100	100	95	0. 8–2. 5	. 24	[3] 5. 1–7. 3	Moderate.
100	100	95	0. 8–2. 5	. 20	5. 1–6. 0	Moderate.
100	95	90	0. 2–0. 8	. 20	5. 1–5. 5	Moderate.
95	90	55	0. 8–2. 5	. 10	6. 1–6. 5	Moderate.
95	90	55	0. 8–2. 5	. 16	5. 6–6. 5	Moderate.
65	45	5	(4)	. 02	5. 6–6. 0	Very low.
100	100	95	0. 8–2. 5	. 22	6. 1–6. 5	Moderate.
95	90	55	0. 8–2. 5	. 16	5. 6–6. 5	Moderate.
65	45	5	(4)	. 02	5. 6–6. 0	Very low.

[4] More than 10.
[5] Variable.
[6] Less than 0.05.
[7] Less than 0.08.

TABLE 5.—*Suitability, limitations, and characteristics of*

[Engineers and others should not apply specific values to the

Soil series or soil type	Suitability as a source of—		Limitations for—		
	Topsoil	Sand and gravel	Subgrade for highways	Foundations for low buildings	Sewage disposal
Adrian muck (16 to 42 inches thick over sand) (Ad).	Poor; soil is erodible and oxidizes rapidly.	Poor; underlying sand varies greatly in composition and contains fines in many places; sand difficult to remove because of the high water table.	Very severe; very unstable.	Very severe; soil material is highly compressible and has undesirable characteristics for use in construction.	Very severe because of high water table.
Alluvial land:					
Loamy (Ae, Ag).	Both surface layer and subsoil good.	Fair; in places the underlying gravel and sand is mixed with considerable fines.	Moderate; the subsoil and substratum subject to small volume change; no severe distortion in pavement where this material is used for subgrade.	Moderate; moderately low compressibility; fair shear strength.	Very severe; subject to periodic overflow; filter fields will not function when flooded.
Sandy (Ah)	Both surface layer and subsoil fair.	Fair; in places the underlying gravel and sand are mixed with considerable fines.	Slight both in the subsoil and in the substratum; medium stability and small volume change when wet.	Moderate; low compressibility; good to fair shear strength; fairly easy to compact.	Very severe; subject to periodic overflow; filter fields will not function when flooded.
Wet (Al)	Both surface layer and subsoil good; high water table and subject to ponding.	Fair; in places the underlying sand and gravel are mixed but contain considerable fines.	Very severe below the surface material; moderate elasticity; moderate volume change when content of moisture changes; high water table.	Very severe; moderately low compressibility and fair shear strength; high water table.	Very severe; subject to periodic overflow; filter fields will not function when flooded.
Almena (AmA, AmB, AmB2).	Surface layer good to fair; subsoil fair, unstable on slopes.	Unsuitable	Severe in subsoil; large volume change and loss of bearing capacity when wet; slight in substratum; medium stability and small volume change.	Slight; high bearing capacity; easy to compact; low compressibility; moderately high shear strength.	Severe; fluctuating water table and variable bulk density; requires on-site investigation.

the soils of Pierce County, Wis., for engineering

estimates given in this table for bearing capacity of soils]

Limitations for—Continued					Factors that influence agricultural drainage	Corrosion potential for conduits
Farm ponds		Irrigation	Terraces and diversions	Grassed waterways		
Reservoir area	Embankments					
Severe; pervious; has high water table; suitable for dugout ponds; seal blanket needed for reservoir area.	Severe; pervious; organic surface layer has low stability and is suitable only for low embankments; substratum has high stability but is susceptible to piping.	Moderate; rapid water intake rate and high water-holding capacity; drainage required before irrigating.	Severe; low stability and highly erodible.	Moderate where sand is not exposed; highly erodible; in many places wetness may hinder construction.	Moderately rapid permeability; high water table; subsurface and surface drainage needed; the layer of peat is less than 24 inches thick and is not suitable for drainage.	For metal, very high in the organic material and moderate in the sandy material; for concrete, very high in acidic material; low where the pH is higher than 5.5.
Severe; pervious; bottom of reservoir needs to be compacted.	Severe; semipervious; high stability; small volume change.	Severe; moderate water intake rate and moderate water-holding capacity.	Moderate; no limiting factors.	Slight; no limiting factors.	Moderate permeability; present drainage adequate; subject to overflow.	Low for metal and concrete.
Severe; very pervious; requires a seal blanket.	Severe; pervious; high stability and small volume change when content of moisture changes; in places susceptible to piping.	Severe; rapid water intake rate and low water-holding capacity.	Moderate; sandy; subject to erosion.	Moderate; a cover of plants difficult to establish and maintain.	Rapid permeability; present drainage adequate; subject to overflow.	Low for metal and concrete.
Severe; semipervious; has seasonal high water table; suitable for dugout ponds.	Severe; semipervious; high stability; small volume change.	Severe; moderate water-holding capacity; adequate drainage difficult to obtain.	No runoff------	Severe; wetness may hinder construction.	Moderate permeability; seasonal high water table; surface drainage needed; subject to overflow.	Moderate for metal; low for concrete.
Slight; semipervious; some areas suitable for dugout ponds.	Slight; impervious; large volume change in subsoil; high stability and small volume change in substratum.	Moderate water intake rate and high water-holding capacity; adequate drainage difficult to obtain.	Slight; wetness can hinder construction.	Slight; wetness can hinder construction.	Moderate permeability in subsoil; slow permeability in substratum; surface drainage needed.	Low to moderate for metal; high for concrete.

TABLE 5.—*Suitability, limitations, and characteristics of*

Soil series or soil type	Suitability as a source of—		Limitations for—		
	Topsoil	Sand and gravel	Subgrade for highways	Foundations for low buildings	Sewage disposal
Antigo (AnA, AnB, AnB2).	Surface layer good; subsoil fair to poor, lower part of subsoil gravelly in places.	Good; substratum consists of poorly graded, stratified sand and gravel.	Severe in subsoil; large volume change and has low bearing capacity when wet; slight in substratum; highly stable.	Moderate to severe; high shear strength and very low compressibility; no volume change on wetting; good bearing capacity, but can become quick and flow where excavation is below the level reached by the water table.	Moderate; silt can infiltrate into the drain pipes and gravel beds of the disposal area.
Arenzville (Ar)	Surface layer good; subsoil fair, thick; subject to stream overflow.	Unsuitable	Severe; substratum unstable at all moisture contents; very low stability and very low bearing capacity when wet.	Moderate to severe; liquefies easily and flows when wet; highly susceptible to frost heave and loss of strength on thawing; fair shear strength; moderate compressibility.	Very severe; subject to periodic overflow; filter fields will not function when flooded.
Arland (AsB, AsC2).	Surface layer good; subsoil poor; in many places subsoil is sandy in lower part.	Fair; suitable for sand; bedrock is weakly cemented.	Severe in the subsoil; moderately high volume change and moderately low bearing capacity when wet; slight in the substratum for all types of pavements when confined.	Slight; high shear strength; very low compressibility; no volume change on wetting; has good bearing capacity; becomes quick if excavated below the level reached by the water table.	Moderate; substratum absorbs effluent rapidly.
Auburndale (Au)	Surface layer good, thin; subsoil fair to poor; subject to high water table.	Unsuitable	Severe in subsoil; subsoil subject to moderately large volume change and has low bearing capacity when wet; slight in substratum when the soil has been properly drained and compacted.	Slight; high bearing capacity, good shear strength, and low compressibility; easy to compact; high water table.	Very severe because of high water table.
Boone loamy fine sand (BnB2, BnC2).	Surface layer and subsoil unsuitable; subject to erosion by wind; low water-holding capacity.	Good; suitable for sand; bedrock is weakly cemented.	Slight in upper part of substratum for all types of pavement when confined; slight in lower part of substratum (sandstone).	Slight; underlain by sand or sandstone; high shear strength and no volume change on wetting.	Slight where underlain by a deep layer of sandstone residuum; moderate where sandstone is indurated.
Boone fine sand (BfE2).	Surface layer and subsoil unsuitable; subject to wind erosion; low water-holding capacity.	Good; suitable for sand; bedrock is weakly cemented.	Slight in upper part of substratum for all types of pavement when confined; slight in lower part of substratum (sandstone).	Slight; underlain by sand or sandstone; sand has high shear strength and no volume change on wetting.	Slight where underlain by a deep layer of sandstone residuum; moderate where sandstone is indurated.

the soils of Pierce County, Wis., for engineering—Continued

Limitations for—Continued					Factors that influence agricultural drainage	Corrosion potential for conduits
Farm ponds		Irrigation	Terraces and diversions	Grassed waterways		
Reservoir area	Embankments					
Moderate; pervious	Moderate; semipervious; subsoil has low stability, high volume change; substratum has high stability, small volume change.	Slight; moderate water intake rate and moderate water-holding capacity.	Slight; no limiting factors.	Slight; good where gravelly substratum is not exposed and slopes are no steeper than 12 percent; fair on slopes steeper than 12 percent.	Moderate permeability; present drainage adequate.	Low for metal and concrete.
Moderate; pervious	Moderate; semipervious; medium to low stability, medium volume change.	Moderate; moderate water intake rate and high water-holding capacity; protection from stream overflow needed.	Slight; good for diversions; terraces not needed; nearly level.	Slight; no limiting factors.	Moderate permeability; subject to flooding; protection from stream overflow needed.	Low for metal and concrete.
Severe; pervious	Slight; semipervious; subsoil has medium stability, medium volume change; substratum has high stability, small volume change.	Slight; moderate water intake rate and moderate water-holding capacity.	Moderate; sandy substratum subject to erosion.	Slight; good where sandy substratum is not exposed and the slopes are no steeper than 12 percent; fair where the slopes are steeper than 12 percent.	Moderate permeability; present drainage adequate.	Very high for metal and low for concrete.
Slight; semipervious; seasonal high water table; suitable for dugout ponds.	Slight; impervious; subsoil has low stability, medium volume change; substratum has high stability, low volume change.	Severe; slow water intake rate and high water-holding capacity; adequate drainage difficult to obtain.	Slight; good for diversions; terraces not needed, because of nearly level relief and poor drainage.	Slight; wetness may hinder construction.	Moderate permeability in subsoil; slow permeability in substratum; seasonal high water table; surface drainage needed.	Moderate for metal and high for concrete.
Very severe; very pervious; soil material too porous to hold water.	Severe; very pervious; high stability and small volume change.	Severe; very rapid water intake rate and very low water-holding capacity; subject to wind erosion.	Very severe; has low stability and high erosion potential; cover of plants difficult to establish.	Severe; a cover of plants difficult to establish and maintain.	Very rapid permeability; present drainage excessive.	Low for metal and concrete.
Very severe; very pervious; soil material too porous to hold water.	Severe; very pervious; high stability and small volume change.	Severe; very rapid water intake rate and very low water-holding capacity; subject to wind erosion.	Very severe; has low stability and high erosion potential; cover of plants difficult to establish.	Severe; a cover of plants difficult to establish and maintain.	Very rapid permeability; present drainage excessive.	Low for metal and concrete.

TABLE 5.—*Suitability, limitations, and characteristics of*

Soil series or soil type	Suitability as a source of—		Limitations for—		
	Topsoil	Sand and gravel	Subgrade for highways	Foundations for low buildings	Sewage disposal
Burkhardt loam (BrA).	Surface layer good, dark colored, thin; subsoil poor, thin over sand and gravel, droughty.	Good; suitable for sand; bedrock is weakly cemented.	Moderate in upper part of substratum for all types of pavement when confined; slight in lower part of substratum (sandstone).	Slight; underlain by sand or sandstone; high shear strength and no volume change on wetting.	Slight where underlain by a deep layer of sandstone residuum; moderate where sandstone is indurated.
Burkhardt sandy loam (BuA, BuB).	Surface layer fair, dark colored; subsoil poor, thin over sand and gravel, droughty.	Good in substratum; poorly graded, stratified sand and gravel.	Moderate in subsoil, highly stable when dry, but may soften when moist; slight in substratum and highly stable under wheel loads at all moisture contents.	Slight; strong enough to carry any load of a low building; good shear strength; very low compressibility; no volume change on wetting.	Slight; free draining at a depth of about 20 inches.
Chaseburg silt loam (CaA, CaB).	Surface layer good; subsoil fair, thick; subject to overflow.	Unsuitable	Very severe in substratum; relatively unstable at all moisture contents; very low stability and very low bearing capacity when wet.	Severe; liquefies easily and flows if saturated; highly susceptible to frost heave and loss of bearing capacity on thawing.	Severe; subject to periodic overflow; system will not function when filter fields are flooded.
Chetek sandy loam (ChB, ChD2).	Surface layer fair, thin, droughty; subsoil poor, thin over sand and gravel.	Good in substratum; poorly graded sand and gravel; stratified.	Moderate in subsoil, small volume change, fair stability; slight in substratum, highly stable.	Slight; strong enough to carry any load from a low building; good shear strength; negligible compressibility; no volume change on wetting and drying.	Slight; free draining at a depth of about 20 inches.
Clyde silt loam (Cl)	Surface layer good, thick, dark colored; subsoil fair to poor, clayey; subject to high water table.	Unsuitable	Very severe in the subsoil; material in the subsoil is elastic, large volume change when wet; severe in the substratum, moderate volume change when wet.	Slight; good to fair shear strength and very low compressibility; fairly high bearing capacity; high water table; can become quick and flow if excavated below the level reached by the water table.	Very severe because of a high water table or ponding.
Dakota loam (DaA, DaB, DaC2).	Surface layer good, thick, dark colored; subsoil fair, thin over sand.	Substratum made up of poorly graded sand.	Slight in the subsoil, small volume change and high stability; slight in the substratum, no volume change when wet, suitable for all types of pavement when confined.	Slight; good to fair shear strength and very low compressibility; no volume change on wetting; can become quick and flow if saturated.	Moderate; free draining at a depth of about 30 inches.

the soils of Pierce County, Wis., for engineering—Continued

Limitations for—Continued						Factors that influence agricultural drainage	Corrosion potential for conduits
Farm ponds		Irrigation	Terraces and diversions	Grassed waterways			
Reservoir area	Embankments						
Severe; very pervious; seal blanket required over the gravelly substratum.	Severe; semipervious; high stability and small volume change.	Moderate; rapid water intake rate and low water-holding capacity.	Moderate; shallow over gravelly and sandy substratum.	Moderate; a cover of plants difficult to establish and maintain.		Rapid permeability; present drainage adequate.	Low for metal and concrete.
Severe; very pervious; seal blanket required over the gravelly substratum.	Severe; semipervious; high stability and small volume change.	Moderate; rapid water intake rate and low water-holding capacity.	Moderate; shallow over gravelly and sandy substratum.	Moderate; a cover of plants difficult to establish and maintain.		Rapid permeability; present drainage adequate.	Low for metal and concrete.
Moderate; pervious; bottom of reservoir should be scarified and compacted.	Moderate; semipervious; medium stability and medium volume change.	Slight; moderate water intake rate and high water-holding capacity.	Slight; good for diversions; terraces not needed.	Slight; no limiting factors.		Moderate permeability; present drainage adequate.	Low for metal and concrete.
Severe; very pervious; requires a seal blanket.	Severe; pervious; high stability and small volume change.	Moderate; rapid water intake rate and low water-holding capacity.	Very severe; shallow over sandy and gravelly substratum.	Moderate; fair where the gravelly substratum is not exposed and the slopes are no steeper than 12 percent; poor where the slopes are steeper than 12 percent.		Rapid permeability; present drainage excessive.	Low for metal and concrete.
Slight; semipervious; high water table; suitable for dugout ponds.	Slight; impervious; medium stability and large volume change; stony in places.	Moderate; moderate water intake rate; high water-holding capacity.	Slight; good for diversions; terraces not needed, because of nearly level relief and poor drainage.	Moderate; satisfactory seedbed difficult to establish in clayey subsoil.		Moderately slow permeability; high water table; subsurface or surface drainage needed.	Very high for metal and low for concrete.
Severe; pervious	Severe; semipervious; high stability and small volume change.	Slight; moderate water intake rate and moderate water-holding capacity.	Moderate; sandy substratum; subject to erosion.	Slight; exposed sandy substratum can cause problems.		Moderate permeability; present drainage adequate.	Low for metal and concrete.

TABLE 5.—*Suitability, limitations, and characteristics of*

Soil series or soil type	Suitability as a source of—		Limitations for—		
	Topsoil	Sand and gravel	Subgrade for highways	Foundations for low buildings	Sewage disposal
Dakota loam, rock substratum (DcA, DcB2).	Surface layer good, thick, dark colored; subsoil fair, thin over sand.	Unsuitable; bedrock at a depth of 36 inches or more.	Slight in subsoil, small volume change and high stability; substratum is dolomite bedrock.	Slight; underlain by dolomite bedrock.	Severe; in places dolomite limestone is not sufficiently fissured.
Dakota loam, loamy substratum (DbA, DbB).	Surface layer good, thick, dark colored; subsoil fair, thin over sand.	Unsuitable; loamy material at a depth of 36 inches or more.	Slight in subsoil and substratum; small volume change; high stability.	Slight; moderately low compressibility and fair shear strength; expansive if initially dry.	Moderate because of fine texture of soil material; requires on-site investigation.
Dakota sandy loam (DdA, DdB).	Surface layer fair, thick, droughty; subsoil fair to poor, thin over sand.	Substratum made up of poorly graded sand.	Slight in subsoil, small volume change and medium stability when wet; slight in substratum, stable when moist, no volume change; must be confined for flexible pavement.	Slight; has high shear strength; very low compressibility and no volume change on wetting; can become quick and flow if saturated.	Moderate; free draining at a depth of about 30 inches.
Derinda silt loam (DeA, DeB, DeB2, DeC, DeC2, DeD, DeD2, DeE).	Surface layer good, thin; subsoil poor to unsuitable, clayey.	Unsuitable	Very severe in subsoil, very elastic, very large volume change on wetting; very severe in substratum; material in substratum has weathered from shale or is shale bedrock.	Severe; the material weathered from shale is subject to dangerous expansion if initially dry; has moderate compressibility.	Severe; shallow over shale bedrock.
Derinda silt loam, acid variant (DfC2, DfD2).	Surface layer good, thin; subsoil poor to unsuitable, clayey.	Unsuitable	Very severe in subsoil, very elastic, very large volume change on wetting; severe in substratum; material in substratum has weathered from shale or is shale bedrock.	Severe; the material weathered from shale is subject to dangerous expansion if initially dry; has moderate compressibility.	Severe; shallow over shale bedrock.
Dickinson fine sandy loam (DkB2).	Surface layer good, dark colored; subsoil fair.	Unsuitable	Severe in subsoil and substratum; relatively unstable at all moisture contents; low bearing capacity when wet; liquefies when wet.	Severe; liquefies when saturated; has fair shear strength and moderate compressibility.	Moderate; soil material can liquefy and flow into filter field; drainage adequate.
Downs silt loam (DoB, DoB2, DoC2).	Surface layer good, thick; subsoil fair to poor, depending on the content of clay, thick.	Unsuitable	Severe in subsoil and substratum; large volume change and loss of bearing capacity when wet.	Severe; highly susceptible to frost heave; loses strength on thawing; can lose cohesion and settle when saturated; has moderate compressibility and moderate shear strength.	Moderate; permeability moderately slow.

the soils of Pierce County, Wis., for engineering—Continued

Limitations for—Continued						Factors that influence agricultural drainage	Corrosion potential for conduits
Farm ponds		Irrigation	Terraces and diversions	Grassed waterways			
Reservoir area	Embankments						
Severe; pervious; requires a seal blanket over limestone bedrock.	Severe; semipervious; high stability and small volume change.	Moderate; moderate water intake rate and moderate water-holding capacity.	Moderate; sandy substratum; subject to erosion.	Slight; exposed sandy substratum can cause problems.	Moderate permeability; present drainage adequate.	Low for metal and concrete.	
Moderate; pervious; bottom of reservoir needs to be compacted.	Moderate; high stability and small volume change.	Slight; moderate water intake rate and moderate water-holding capacity.	No limiting factors.	Slight; no limiting factors.	Moderate permeability; present drainage adequate.	Low for metal and concrete.	
Severe; very pervious; requires a seal blanket.	Severe; pervious; high stability and small volume change; in places susceptible to piping.	Moderate; rapid water intake rate and low water-holding capacity.	Moderate; sandy; subject to erosion.	Moderate; cover of vegetation difficult to establish and maintain.	Moderately rapid permeability; present drainage adequate.	Low for metal and concrete.	
Slight; pervious; compact the surface soil or remove the subsoil down to the clayey substratum.	Slight; semipervious; medium stability and large volume change; shale bedrock has high shrink-swell capacity.	Severe; moderate water intake rate and low water-holding capacity; adequate drainage difficult to obtain.	Moderate; in places bedrock near the surface may hinder construction.	Slight where bedrock is not exposed and the slopes are no steeper than 12 percent; moderate where the slopes are steeper than 12 percent.	Moderately slow permeability in subsoil; very slow permeability in substratum; present drainage adequate.	Moderate for metal; low for concrete.	
Slight; pervious; compact the surface soil or remove the subsoil down to the clayey substratum.	Slight; semipervious; medium stability and large volume change; shale bedrock has high shrink-swell capacity.	Severe; moderate water intake rate and low water-holding capacity; adequate drainage difficult to obtain	Moderate; in places bedrock near the surface may hinder construction.	Moderate; in places the exposed acid shale makes it necessary to apply an amendment before grass can be established.	Moderately slow permeability in subsoil; very slow permeability in substratum; present drainage adequate.	Low to moderate for metal; very high for concrete.	
Moderate; moderately pervious.	Moderate; high stability and small volume change.	Moderate; moderate water intake rate and moderately low water-holding capacity.	Slight; generally subject to erosion.	Moderate; a cover of plants may be difficult to establish.	Moderately rapid permeability; present drainage adequate.	Low for metal and concrete.	
Moderate; pervious; compact the surface soil.	Moderate; semipervious; medium stability and large volume change.	Slight; moderate water intake rate; moderate water-holding capacity.	Slight; no limiting factors.	Slight; no limiting factors where the slopes are no steeper than 12 percent; fair where the slopes are steeper than 12 percent.	Moderately slow permeability; present drainage adequate.	Low for metal and concrete.	

TABLE 5.—*Suitability, limitations, and characteristics of*

Soil series or soil type	Suitability as a source of— Topsoil	Suitability as a source of— Sand and gravel	Limitations for— Subgrade for highways	Limitations for— Foundations for low buildings	Limitations for— Sewage disposal
Dubuque silt loam (DsA, DsB, DsB2, DsC, DsC2, DsD, DsD2, DsE, DsE2, DsF).	Surface layer good; upper part of the subsoil fair to poor, thin; lower part of the subsoil unsuitable, clayey.	Unsuitable	Severe in subsoil and in upper part of substratum, highly plastic, and extremely large volume change when wet, elastic; slight in lower part of substratum; underlain by dolomite.	Slight where the layer of clay weathered from bedrock is thin; severe where that layer is thick; large volume change in clay at varying moisture contents; low shear strength; very high compressibility.	Severe; the clay in the subsoil restricts percolation; bedrock near the surface permits contamination of the ground water.
Dubuque soils (DtB3, DtC3, DtD3). (See Dubuque silt loam).					
Dunbarton silt loam (DuB, DuB2, DuC, DuC2, DuD, DuD2, DuE, DuE2).	Surface layer good; subsoil poor.	Unsuitable	Severe in subsoil and in upper part of substratum, highly plastic, and large volume change when wet; slight in dolomite in lower part of substratum.	Slight; dolomite within 20 inches of the surface.	Severe; fissured dolomite near the surface permits contamination of the ground water.
Dunbarton complexes (DvC, DvC2, DvD, DvD2, DvE, DvE2). (See Dunbarton silt loam).					
Edith soils (EdC2, EdD, EdD2, EdE).	Surface layer fair to poor, thin, variable in texture; subsoil unsuitable, gravelly and sandy.	Good; substratum contains poorly graded sand and gravel.	Slight in subsoil and substratum; soil material highly stable regardless of moisture content.	Slight; will carry any load imposed by a low building; good shear strength; negligible compressibility; no volume change on wetting and drying.	Slight; free draining at a depth of about 20 inches.
Edith-Wykoff complexes (EwC2, EwD2, EwD3, EwE). (See Edith soils for interpretations for Edith soils, and Wykoff loam and Wykoff silt loam for interpretations for Wykoff soils).					

the soils of Pierce County, Wis., for engineering—Continued

Limitations for—Continued					Factors that influence agricultural drainage	Corrosion potential for conduits
Farm ponds		Irrigation	Terraces and diversions	Grassed waterways		
Reservoir area	Embankments					
Moderate; pervious.	Moderate; semipervious; medium stability and large volume change; clay substratum has high shrink-swell potential.	Moderate; moderate to high water intake rate and moderate to high water-holding capacity.	Moderate; in places bedrock near the surface may hinder construction.	Slight; no limiting factors where the slopes are no steeper than 12 percent; fair where the slopes are steeper than 12 percent.	Moderate permeability in subsoil; slow permeability in substratum; present drainage adequate.	Low to moderate for metal; low for concrete.
Severe; pervious	Severe; semipervious; medium stability and large volume change; high shrink-swell potential.	Severe; moderate water intake rate; moderate water-holding capacity.	Severe; bedrock near the surface may hinder construction.	Moderate where the slopes are no steeper than 12 percent; severe where the slopes are steeper than 12 percent.	Moderately slow permeability in subsoil; slow permeability in substratum; present drainage adequate.	Low to moderate for metal; low for concrete.
Severe; very pervious.	Severe; pervious; high stability and small volume change.	Severe; rapid water intake rate and low water-holding capacity.	Severe; shallow to gravelly and sandy substratum.	Severe; satisfactory seedbed difficult to establish.	Rapid permeability; present drainage excessive.	Low for metal and concrete.

TABLE 5.—*Suitability, limitations, and characteristics of*

Soil series or soil type	Suitability as a source of—		Limitations for—		
	Topsoil	Sand and gravel	Subgrade for highways	Foundations for low buildings	Sewage disposal
Fayette silt loam, benches (FaA, FaB, FaC2).	Surface layer good; subsoil fair to poor, thick, in places sandy in lower part.	Fair to poor; substratum contains poorly graded sand and layers of silty material.	Very severe in subsoil, soil material elastic, has high volume change on wetting; severe in substratum, unstable at all moisture contents.	Severe; highly susceptible to frost heave; loses strength on thawing; loses cohesion and settles when saturated; has fair shear strength; subject to liquefaction.	Moderate; silty material can infiltrate into the drainpipes and gravel beds of the disposal area.
Floyd silt loam (FlB).	Surface layer good, thick, dark colored; subsoil fair to poor, clayey; subject to high water table.	Unsuitable	Very severe in subsoil, soil material elastic and subject to large volume change when wet; severe in substratum, fair to poor for subgrade, moderate volume change when wet.	Slight; low compressibility; fair shear strength; high water table.	Very severe because of high water table.
Freeon silt loam (FnB2, FnC2).	Surface layer good; subsoil fair; lower part of subsoil gravelly in places and has low water-holding capacity.	Fair to poor; substratum contains pockets of well-graded sand and gravel.	Severe in subsoil, somewhat unstable at all moisture contents, moderately low bearing capacity; slight in substratum, medium stability, only small volume change when wet.	Slight; low compressibility; good to fair shear strength; easy to compact.	Moderate in many places, but severe where drainage is somewhat poor; silty material can infiltrate the drainpipes and gravel beds of the filter field; in some areas the soil material has high bulk density.
Freer silt loam (Fr)	Surface layer good; subsoil fair; lower part of subsoil gravelly in places and has low water-holding capacity.	Fair to poor; in places substratum contains pockets of well-graded sand or gravel.	Severe in subsoil, somewhat unstable at all moisture contents and has moderately low bearing capacity; slight in substratum; material in substratum had medium stability and small volume change.	Slight; low compressibility; good to fair shear strength; easy to compact.	Severe; has fluctuating water table and variable bulk density.
Gale silt loam (GaB, GaB2, GaC2, GaD2).	Surface layer good; subsoil fair to poor; lower part of subsoil sandy in places.	Fair; substratum suitable for poorly graded sand; bedrock weakly cemented.	Severe in subsoil, large volume change and has low bearing capacity when wet; slight in substratum, no volume change when wet; may need to be confined if loose.	Slight; very low compressibility; no volume change on wetting; becomes quick and flows if excavation is below level reached by the water table.	Moderate, except severe where underlain by bedrock.

the soils of Pierce County, Wis., for engineering—Continued

Limitations for—Continued					Factors that influence agricultural drainage	Corrosion potential for conduits
Farm ponds		Irrigation	Terraces and diversions	Grassed waterways		
Reservoir area	Embankments					
Slight; pervious	Slight; semipervious; medium stability and medium volume change above layers of sandy material.	Slight; moderate water intake rate and high water-holding capacity.	Slight; no limiting factors.	Slight; no limiting factors where the slopes are no steeper than 12 percent; fair where the slopes are steeper than 12 percent.	Moderate permeability; present drainage adequate.	Low for metal; low to moderate for concrete.
Slight; semipervious; has high water table; suitable for dugout ponds.	Slight; impervious; medium stability; large volume change; moderate shrink-swell potential; some areas stony.	Moderate; moderate water intake rate; high water-holding capacity; drainage required before irrigating.	Slight; wetness may hinder construction.	Moderate; satisfactory seedbed difficult to establish in clayey subsoil; wetness may hinder construction.	Moderately slow permeability; high water table; subsurface drainage needed.	High for metal; low for concrete.
Slight; pervious	Slight; semipervious; subsoil medium in stability and subject to large volume change; substratum highly stable and subject to small volume change.	Moderate; moderate to slow water intake rate and moderate water-holding capacity.	Slight; stones may hinder construction.	Slight; stones may hinder construction.	Moderately slow permeability; surface drains beneficial.	Low for metal; low to moderate for concrete.
Slight; semipervious; in places suitable for dugout ponds.	Slight; semipervious; subsoil has medium stability, small volume change.	Moderate; slow water intake rate; high water-holding capacity; adequate drainage difficult to obtain.	Moderate; wetness and stones may hinder construction.	Slight; stones and wetness may hinder construction.	Moderately slow permeability; surface drainage needed.	Low for metal; moderate for concrete.
Moderate; pervious; bottom of reservoir should be scarified and compacted.	Moderate; semipervious; subsoil has medium stability, large volume change; substratum has high stability, small volume change.	Slight; moderate water intake rate and moderate water-holding capacity.	Slight; no limiting factors.	Slight where the sandy substratum is not exposed and the slopes are no steeper than 12 percent; moderate where the slopes are steeper than 12 percent.	Moderate permeability; present drainage adequate.	Low for metal and concrete.

TABLE 5.—*Suitability, limitations, and characteristics of*

Soil series or soil type	Suitability as a source of—		Limitations for—		
	Topsoil	Sand and gravel	Subgrade for highways	Foundations for low buildings	Sewage disposal
Gale silt loam, thin solum variant (GtC2, GtD, GtD2, GtE).	Surface layer fair, thin; subsoil fair to poor, thin.	Unsuitable; underlain by thinly bedded siltstone and sandstone.	Severe in subsoil, moderate stability and small volume change when wet; moderate in substratum; substratum consists of thinly bedded siltstone and sandstone.	Slight; thinly bedded siltstone and sandstone.	Severe because of bedrock near the surface and degree of induration of bedrock.
Halder loam (HaA)	Surface layer good; subsoil fair to poor; in many places lower part of subsoil is gravelly.	Good in substratum; substratum contains poorly graded, stratified sand and gravel.	Moderate in subsoil, has fair stability, small volume change when wet; slight in substratum; substratum highly stable under wheel loads.	Slight; high shear strength; negligible compressibility; no appreciable volume change on wetting.	Severe; has fluctuating water table; requires on-site investigation.
Halder loam, sandy substratum (HdA).	Surface layer good; subsoil fair; in many places lower part of subsoil is sandy.	Good in substratum; substratum contains poorly graded sand and in places contains layers of silty material.	Moderate in subsoil, small volume change and good stability; slight in substratum, no volume change on wetting, suitable for all types of pavement when confined.	Moderate; high shear strength; no volume change on wetting; low compressibility; can become quick and flow if saturated during excavation.	Very severe; has high water table.
Hesch loam, loamy substratum (HlB, HlB2, HlC2, HlD2).	Surface layer good, thick, dark colored; subsoil fair.	Unsuitable	Moderate in subsoil and substratum; small volume change and little pavement distortion.	Slight; in places bedrock is at a depth between 42 and about 60 inches; the loamy material above bedrock is expansive; has fair shear strength; moderate compressibility.	Moderate; has medium-textured substratum.
Hesch fine sandy loam, loamy substratum (HeB2, HeC2, HeD2).	Surface layer good to fair, thick, dark colored; subsoil fair.	Unsuitable	Slight in subsoil and substratum; small volume change and little distortion of pavement.	Slight; in some places bedrock is at a depth between 42 and about 60 inches; the loamy material above the bedrock is expansive, has fair shear strength, and has moderate compressibility.	Moderate; has medium-textured substratum.
Hixton loam, loamy substratum (HtB, HtC2, HtD2).	Surface layer good; subsoil fair.	Unsuitable	Slight in subsoil and substratum; small volume change and little distortion of pavement.	Slight; depth to bedrock ranges from 42 to about 60 inches; the loamy material above the bedrock is expansive, has fair shear strength, and has moderate compressibility.	Moderate; has medium-textured substratum.

the soils of Pierce County, Wis., for engineering—Continued

Limitations for—Continued					Factors that influence agricultural drainage	Corrosion potential for conduits
Farm ponds		Irrigation	Terraces and diversions	Grassed waterways		
Reservoir area	Embankments					
Severe; pervious	Severe; pervious; subsoil is thin and has moderate stability, small volume change; substratum consists of thinly layered sandstone and siltstone.	Severe; moderate water intake rate and low water-holding capacity.	Severe; shallow to bedrock.	Severe; shallow to bedrock.	Moderate permeability; present drainage adequate.	Low for metal; high for concrete.
Moderate; pervious; bottom of reservoir should be scarified and compacted; in places suitable for dugout ponds.	Moderate; semipervious; high to medium stability and small volume change.	Moderate; moderate intake rate and high water-holding capacity; drainage necessary before irrigating.	Slight; good for diversions; terraces not needed, because of nearly level relief and somewhat poor drainage.	Slight where the sandy substratum is not exposed; wetness may hinder construction.	Moderate permeability; has seasonal high water table; surface drainage beneficial.	Low for metal and concrete.
Severe; pervious; bottom of reservoir should be scarified and compacted; in places suitable for dugout ponds.	Severe; semipervious; high to medium stability and small volume change.	Moderate; moderate water intake rate and high water-holding capacity; drainage necessary before irrigating.	Slight; good for diversions; terraces not needed, because of nearly level relief and somewhat poor drainage.	Slight where the sandy substratum is not exposed; wetness may hinder construction.	Moderate permeability; has seasonal high water table; surface drainage beneficial.	Moderate for metal; low for concrete.
Moderate; pervious	Moderate; semipervious; high stability and small volume change; in places susceptible to piping.	Slight; moderate water intake rate and moderate water-holding capacity.	Slight; no limiting factors.	Slight; no limiting factors.	Moderate permeability; present drainage adequate.	Low for metal and concrete.
Moderate; very pervious.	Moderate; pervious; high stability and small volume change; susceptible to piping.	Slight; rapid water intake rate and moderate to low water-holding capacity.	Slight; soil material sandy and subject to erosion.	Moderate; a cover of plants difficult to establish and maintain; moderately erodible.	Moderate to rapid permeability; present drainage excessive.	Low for metal and concrete.
Moderate; pervious	Moderate; semipervious; high stability and small volume change; susceptible to piping.	Slight; moderate water intake rate and moderate water-holding capacity.	Slight; no limiting factors.	Slight; no limiting factors.	Moderate permeability; present drainage adequate.	Low for metal and concrete.

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TABLE 5.—*Suitability, limitations, and characteristics of*

Soil series or soil type	Suitability as a source of—		Limitations for—		
	Topsoil	Sand and gravel	Subgrade for highways	Foundations for low buildings	Sewage disposal
Hixton fine sandy loam (HmC2, HmD2).	Surface layer fair; subsoil fair to poor; lower part of subsoil generally droughty.	Substratum is poorly graded sand; sandstone is weakly cemented.	Moderate in subsoil, small volume change and little distortion of pavement; slight in substratum; material in substratum highly stable under wheel loads.	Slight; very low compressibility; no volume change on wetting; good shear strength if saturated; can flow while excavation is taking place.	Moderate; free draining at a depth of 3 feet.
Hixton fine sandy loam, loamy substratum (HnB, HnB2, HnC, HnC2, HnD, HnD2, HnE).	Both surface layer and subsoil fair.	Unsuitable	Slight in subsoil and substratum; small volume change and little distortion of pavement.	Slight; depth to bedrock ranges from 42 to about 60 inches; the loamy material above the bedrock is expansive, has fair shear strength, and has moderate compressibility.	Moderate; has medium-textured substratum.
Lamont very fine sandy loam (LaB2, LaC2, LaD2).	Both surface layer and subsoil fair.	Unsuitable	Moderate in subsoil and substratum; somewhat unstable at all moisture contents; low bearing capacity when wet; liquefies when wet.	Moderate; liquefies when saturated; fair shear strength and moderate compressibility.	Moderate; soil material can liquefy and flow into filter field; drainage adequate.
Lawler loam (LcA)	Surface layer good, thick, dark colored; subsoil good to fair, thick.	Good in substratum; poorly graded sand.	Slight in subsoil, small volume change and high stability; slight in substratum, no volume change when wet, suitable for all types of pavement when confined.	Slight; good shear strength and very low compressibility; no volume change on wetting; can become quick and flow if saturated.	Very severe; high water table.
Lawler silt loam (LwA, LwB).	Surface layer good, thick, dark colored; subsoil fair, thin over sand.	Good; substratum consists of poorly graded sand.	Slight in subsoil; subsoil has small volume change and good stability; slight in substratum, no volume change when wet; substratum suitable for all types of pavement when confined.	Slight; good shear strength; very low compressibility; no volume change on wetting; can become quick and flow if saturated.	Very severe; high water table.
Meridian loam (MdA, MdB).	Surface layer good; subsoil fair; lower part of subsoil sandy in many places.	Good; substratum consists of poorly graded sand; in places it contains layers of silty material.	Moderate in subsoil, small volume change and good stability; slight in substratum, no volume change in substratum on wetting, suitable for all types of pavement when confined.	Slight; high shear strength; no volume change on wetting; low compressibility; may become quick and flow if saturated while excavation is taking place.	Slight; free draining below a depth of about 30 inches.

the soils of Pierce County, Wis., for engineering—Continued

Limitations for—Continued						Factors that influence agricultural drainage	Corrosion potential for conduits
Farm ponds		Irrigation	Terraces and diversions	Grassed waterways			
Reservoir area	Embankments						
Severe; very pervious; a seal blanket required.	Severe; pervious; high stability and small volume change; susceptible to piping.	Moderate; rapid water intake rate and moderately low water-holding capacity.	Moderate; soil material sandy and subject to erosion.	Moderate; cover of plants difficult to establish and maintain; moderately erodible.		Moderate permeability in the subsoil; rapid in the substratum; present drainage excessive.	Low for metal and concrete.
Severe; very pervious; a seal blanket required.	Severe; pervious; high stability and small volume change; susceptible to piping.	Moderate; rapid water intake rate and moderate to low water-holding capacity.	Moderate; soil material sandy and subject to erosion.	Moderate; cover of plants difficult to establish and maintain; moderately erodible.		Moderate to rapid permeability; present drainage excessive.	Low for metal and concrete.
Slight; moderately pervious.	Moderate; high stability and small volume change.	Slight; moderate water intake rate and moderate to low water-holding capacity.	Slight; generally subject to erosion.	Slight; cover of plants may be difficult to establish.		Moderately rapid permeability; present drainage adequate.	Low for metal and concrete.
Moderate; pervious; bottom of reservoir should be scarified and compacted; some areas suitable for dugout ponds.	Moderate; semipervious; high to medium stability and small volume change.	Moderate; moderate water intake rate and moderate water-holding capacity; drainage necessary before irrigating.	Slight for diversions; terraces not needed, because of nearly level relief and somewhat poor drainage.	Slight where sandy and gravelly substratum is not exposed; wetness may hinder construction.		Moderate permeability; has seasonal high water table; surface drainage beneficial.	High for metal; low for concrete.
Moderate; pervious.	Moderate; semipervious; subsoil has medium stability, medium volume change; substratum has high stability, small volume change.	Moderate; moderate water intake rate and high water-holding capacity; drainage required before irrigating.	Slight; wetness may hinder construction.	Slight; where the sandy substratum is not exposed; wetness may hinder construction.		Moderately permeable; surface drainage beneficial.	High for metal; low for concrete.
Moderate; pervious.	Moderate; semipervious; medium to high stability; small volume change.	Moderate; moderate water intake rate and moderate water-holding capacity.	Moderate; substratum sandy and highly erodible.	Moderate; suitable where sandy substratum is not exposed and the slopes are no steeper than 12 percent.		Moderately permeable; present drainage adequate.	Low for metal and concrete.

TABLE 5.—*Suitability, limitations, and characteristics of*

Soil series or soil type	Suitability as a source of—		Limitations for—		
	Topsoil	Sand and gravel	Subgrade for highways	Foundations for low buildings	Sewage disposal
Onamia loam (OmA, OmB, OmB2, OmC2, OmD2).	Surface layer good; subsoil fair to poor; in places lower part of subsoil is gravelly.	Good; substratum consists of well-graded sand and of some layers of poorly graded gravelly material; stratified.	Slight in subsoil, good if compacted properly; slight in substratum; substratum highly stable, no volume change when wet.	Slight; high shear strength; negligible compressibility; no volume change on wetting.	Slight; free draining at a depth of 2 to 3 feet.
Onamia sandy loam (OnB, OnC2).	Surface layer fair; subsoil fair to poor; in places lower part of subsoil is gravelly.	Good; substratum consists of well-graded sand and of some layers of poorly graded gravelly material; stratified.	Slight in subsoil, good when compacted properly; slight in substratum; substratum highly stable, no volume change when wet.	Slight; high shear strength; negligible compressibility; no volume change on wetting.	Slight; free draining at a depth of 2 to 3 feet.
Orion silt loam (Or).	Surface layer good; subsoil fair, thick.	Unsuitable	Severe in subsoil and substratum; somewhat unstable at all moisture contents; very low stability and very low bearing capacity when wet.	Severe; liquefies easily and flows if excavated while soil material is saturated; highly susceptible to frost heave and loss of bearing capacity on thawing; moderate compressibility.	Very severe; subject to periodic stream overflow; filter fields will not function when soil is flooded.
Ostrander silt loam (OsA, OsB, OsB2, OsC2).	Surface layer good, thick, dark colored; subsoil fair to poor; in places soil material in lower part of subsoil clayey and plastic.	Unsuitable	Severe in subsoil and substratum; large volume change and loss of bearing capacity when wet.	Severe; expansive if initially dry; fair shear strength; moderate compressibility.	Severe; substratum generally fine textured; on-site investigation required.
Otterholt silt loam (OtB, OtB2, OtC, OtC2, OtC3, OtD2).	Surface layer good; subsoil fair, thick.	Poor; substratum contains pockets of well-graded sand and gravel.	Severe in subsoil, somewhat unstable at all moisture contents; slight in substratum, has high stability, little volume change when wet.	Slight; low compressibility; good to fair shear strength; easy to compact.	Moderate; permeability moderately slow.

the soils of Pierce County, Wis., for engineering—Continued

Limitations for—Continued						Factors that influence agricultural drainage	Corrosion potential for conduits
Farm ponds		Irrigation	Terraces and diversions	Grassed waterways			
Reservoir area	Embankments						
Severe; pervious	Moderate; semipervious; medium to high stability; small volume change.	Slight; moderate water intake rate and moderate water-holding capacity.	Moderate; substratum sandy and gravelly; highly erodible.	Slight where the sandy substratum is not exposed and the slopes are no steeper than 12 percent; fair where the slopes are steeper than 12 percent.	Moderately permeable; present drainage adequate.	Low for metal and concrete.
Severe; very pervious.	Moderate; pervious; high stability and small volume change; in places susceptible to piping.	Moderate; moderate to rapid water intake rate; moderate to low water-holding capacity.	Moderate; soil material sandy and highly erodible.	Moderate where the gravelly substratum is not exposed; moderately erodible.	Moderately permeable; present drainage adequate.	Low for metal and concrete.
Moderate; pervious	Moderate; semipervious; medium stability and medium volume change; in places susceptible to piping.	Moderate; moderate water intake rate and high water-holding capacity; drainage and protection from stream overflow needed.	Slight; good for diversions; terraces not needed, because of nearly level relief and hazard of flooding.	Slight; wetness may hinder construction.	Moderately permeable; subject to stream overflow; surface drainage beneficial.	Low for metal and concrete.
Slight; pervious	Slight; semipervious; medium stability and large volume change.	Slight; moderate water intake rate and moderately high water-holding capacity.	Slight; stones may hinder construction.	Slight where the slopes are no steeper than 12 percent; stones may hinder construction; fair where the slopes are steeper than 12 percent.	Moderate to moderately slow permeability; present drainage adequate.	Low to moderate for metal and concrete.
Moderate; pervious	Moderate; semipervious; subsoil medium in stability and in volume change; substratum high in stability; small volume change.	Slight; moderate water intake rate and moderately high water-holding capacity.	Slight; no limiting factors.	Slight; no limiting factors where the slopes are no steeper than 12 percent; fair where the slopes are steeper than 12 percent.	Moderately slow permeability; present drainage adequate.	Low for metal and concrete.

TABLE 5.—*Suitability, limitations, and characteristics of*

Soil series or soil type	Suitability as a source of—		Limitations for—		
	Topsoil	Sand and gravel	Subgrade for highways	Foundations for low buildings	Sewage disposal
Plainfield loamy sand (PmA, PmB, PmB2, PmC, PmC2).	Both surface layer and subsoil unsuitable; droughty and subject to wind erosion.	Good; substratum consists of poorly graded sand; contains a few pebbles in some places.	Slight in substratum; lacks stability under wheel loads, except when moist; no volume change when wet; suitable for all types of pavement when confined.	Slight; very low compressibility; no volume change when content of moisture changes; good shear strength; can liquefy if excavated when soil material is saturated.	Slight; free draining throughout soil profile.
Port Byron silt loam (PoA, PoB, PoC2).	Surface layer good, thick, dark colored; subsoil fair, thick.	Unsuitable----------	Severe both in subsoil and substratum; moderate volume change and large loss of bearing capacity when wet.	Severe; high compressibility; fair shear strength; can be expansive if subjected to wide fluctuation in moisture content.	Moderate; permeability moderately slow.
Racine silt loam (RaB, RaB2, RaC2).	Surface layer good, thick, dark colored; subsoil fair to poor; in places lower part of subsoil clayey and plastic.	Unsuitable----------	Severe in subsoil and substratum; large volume change and loss of bearing capacity when wet.	Moderate; expansive if initially dry; fair shear strength; moderate compressibility.	Severe; substratum generally fine textured.
Renova silt loam (ReA, ReB, ReB2, ReC, ReC2, ReC3, ReD, ReD2, ReD3).	Surface layer good; subsoil fair to poor, clayey and plastic in places.	Unsuitable----------	Severe both in subsoil and substratum; moderately large volume change and loss of bearing capacity when wet.	Moderate; low compressibility; good to fair shear strength; easy to compact.	Severe; substratum generally fine textured.
Renova fine sandy loam, sandy variant (RfB2, RfC2, RfD2).	Both surface layer and subsoil fair.	Unsuitable----------	Severe in subsoil, somewhat unstable at all moisture contents, low bearing capacity when wet, subject to liquefaction; severe in substratum, moderately large volume change and loss of bearing capacity when wet.	Moderate; low compressibility; good to fair shear strength; easy to compact.	Severe; substratum generally fine textured.

the soils of Pierce County, Wis., for engineering—Continued

Limitations for—Continued						Factors that influence agricultural drainage	Corrosion potential for conduits
Farm ponds		Irrigation	Terraces and diversions	Grassed waterways			
Reservoir area	Embankments						
Very severe; very pervious.	Severe; pervious; high stability; small volume change; susceptible to piping.	Moderate; very rapid water intake rate and very low water-holding capacity; subject to wind erosion.	Very severe; soil material sandy throughout profile; highly erodible.	Moderate where the slopes are no steeper than 6 percent; a cover of plants difficult to establish and maintain; poor where the slopes are steeper than 6 percent, highly erodible.	Very rapid permeability; present drainage excessive.	Low for metal and concrete.	
Moderate; pervious	Moderate; semipervious; medium to low stability; large volume change; susceptible to piping.	Slight; moderate water intake rate and high water-holding capacity.	Slight; no limiting factors.	Slight; no limiting factors where the slopes are no steeper than 12 percent; fair where the slopes are steeper than 12 percent.	Moderately slow permeability; present drainage adequate.	Low for metal and concrete.	
Moderate; pervious	Moderate; semipervious; medium stability; moderately large volume change.	Slight; moderate water intake rate and moderately high water-holding capacity.	Slight; no limiting factors.	Slight; no limiting factors.	Moderate permeability; present drainage adequate.	Low to moderate for metal and concrete.	
Slight; pervious	Slight; semipervious; medium stability; moderately large volume change.	Moderate; moderate water intake rate and moderate water-holding capacity.	Slight; stones can hinder construction.	Slight where the slopes are no steeper than 12 percent, but stones can hinder construction in places; fair where the slopes are steeper than 12 percent.	Moderate permeability; present drainage adequate.	Low to moderate for metal and concrete.	
Moderate; pervious	Slight; high stability; small volume change.	Moderate; rapid water intake rate and moderate to low water-holding capacity.	Moderate; soil material sandy throughout profile; subject to erosion.	Moderate; a cover of plants difficult to establish and maintain; moderately erodible.	Moderately slow permeability; present drainage adequate.	Low to moderate for metal and concrete.	

TABLE 5.—*Suitability, limitations, and characteristics of*

Soil series or soil type	Suitability as a source of—		Limitations for—		
	Topsoil	Sand and gravel	Subgrade for highways	Foundations for low buildings	Sewage disposal
Riverwash (Rh)	Unsuitable	Good; subsoil and substratum contain poorly graded sand and gravel.	Slight both in subsoil and substratum; highly stable, regardless of content of moisture.	Slight; strong enough to carry any load from a low building; good shear strength; negligible compressibility; no volume change on wetting and drying.	Very severe; subject to overflow.
Rockton complexes (RoB, RoC2) (Rockton loam part).	Surface layer good; subsoil fair to poor, thin over bedrock.	Unsuitable	Severe in subsoil, somewhat elastic, large volume change when wet; slight in substratum, underlain by dolomite bedrock.	Slight; dolomite bedrock.	Severe in soil material over the fissured dolomite; contamination of ground water probable if soils are used for sewage disposal.
Rozetta silt loam, benches (RtA, RtB).	Surface layer good; subsoil fair to poor, thick in places, sandy in lower part.	Good; substratum contains poorly graded sand and layers of silty material.	Very severe in subsoil, high change in volume and low bearing capacity when wet, elastic; severe in substratum, somewhat unstable at all moisture contents.	Severe; highly susceptible to frost heave; in places soil material can lose cohesion and settle when saturated; has fair shear strength; may liquefy.	Moderate in most places, but severe where drainage approaches somewhat poor; silty material can infiltrate into the drainpipes and gravel filter beds.
Sable silt loam (Sa).	Surface layer good; subsoil poor, clayey, high water table.	Unsuitable	Severe in subsoil, has high plasticity, extremely high volume change when content of moisture changes; very severe in substratum, moderately large volume change and loss of bearing capacity when wet.	Very severe; highly susceptible to frost heave and loss of bearing capacity on thawing; loses cohesion and settles when saturated; has moderate compressibility and moderate shear strength.	Very severe because of high water table.
Santiago silt loam (SbB, SbB2, SbC2).	Surface layer good; subsoil fair; lower part of subsoil is gravelly in places, has low water-holding capacity.	Fair; in places substratum contains pockets of well-graded sand and gravel.	Severe in subsoil, somewhat unstable at all moisture contents, has low stability and low bearing capacity when wet; slight in substratum, good if properly compacted.	Slight; low compressibility; good to fair shear strength; easy to compact.	Moderate; silty material can infiltrate into the drainpipes and gravel filter beds.

See footnote at end of table.

the soils of Pierce County, Wis., for engineering—Continued

Limitations for—Continued						Factors that influence agricultural drainage	Corrosion potential for conduits
Farm ponds		Irrigation	Terraces and diversions	Grassed waterways			
Reservoir area	Embankments						
(1)	(1)	(1)	(1)	(1)		(1)	Low for metal and concrete.
Moderate; pervious.	Moderate; semipervious; medium stability and medium volume change.	Moderate; moderate water intake rate and moderate water-holding capacity.	Moderate; in places stones and bedrock near the surface hinder construction.	Slight; good where bedrock is not exposed and the slopes are no steeper than 12 percent; fair where the slopes are steeper than 12 percent.		Moderate permeability; present drainage adequate.	Low to moderate for metal; low for concrete.
Slight; pervious	Slight; semipervious; medium stability and large volume change; substratum susceptible to piping.	Moderate; moderate water intake rate and moderately high water-holding capacity.	Slight; no limiting factors.	Slight; no limiting factors.		Moderate permeability; present drainage adequate.	Low for metal; moderate for concrete.
Slight; semipervious; has high water table; suitable for dugout ponds.	Slight; semipervious; has medium stability; large volume change.	Severe; moderate water intake rate and high water-holding capacity; adequate drainage difficult to obtain.	Slight for diversions; terraces not needed, because of nearly level relief and very poor drainage.	Moderate; in places wetness may hinder construction.		Moderately slow permeability.	High for metal; low for concrete.
Slight; pervious	Slight; semipervious; subsoil has medium stability, large volume change; substratum has high stability, small volume change.	Slight; moderate water intake rate and moderate water-holding capacity.	Slight; stones may hinder construction.	Slight; where the slopes are no steeper than 12 percent; in places stones can hinder construction; fair where the slopes are steeper than 12 percent.		Moderate permeability; present drainage adequate.	Low for metal and concrete.

TABLE 5.—*Suitability, limitations, and characteristics of*

Soil series or soil type	Suitability as a source of— Topsoil	Sand and gravel	Limitations for— Subgrade for highways	Foundations for low buildings	Sewage disposal
Sargeant silt loam (SgA, SgB, SgB2, SgC, SgC2).	Surface layer good; subsoil fair to poor, clayey and plastic in places.	Unsuitable	Severe both in the subsoil and substratum; moderately large volume change and loss of bearing capacity when wet.	Moderate; low compressibility; good to fair shear strength; easy to compact.	Very severe; has high water table.
Schapville silt loam (ShC, ShC2, ShD2, ShE2).	Surface layer good; thick, dark colored; subsoil poor to unsuitable, clayey, thin over shale bedrock.	Unsuitable	Very severe in subsoil; very elastic and subject to very large volume change; very severe in substratum; substratum consists of shale residuum over shale bedrock.	Very severe; shale residuum subject to dangerous expansion if initially dry; moderate compressibility.	Severe because of shale bedrock near the surface; the level of the water table fluctuates slightly; onsite investigation required.
Schapville silt loam, wet subsoil variant (SkB2).	Surface layer good, thick, dark colored; subsoil poor to unsuitable, clayey, thin over shale bedrock.	Unsuitable	Very severe in subsoil, very elastic and subject to very large volume change; very severe in substratum; substratum consists of shale residuum over shale bedrock; has high water table.	Very severe; shale residuum subject to dangerous expansion if initially dry; moderate compressibility; high water table.	Very severe; has high water table.
Seaton silt loam (SnB, SnB2, SnC, SnC2, SnC3, SnD, SnD2, SnD3, SnE, SnE2).	Surface layer good; subsoil fair, thick.	Unsuitable	Severe both in subsoil and substratum; somewhat unstable at all moisture contents; low in stability and has low bearing capacity when wet.	Severe; high compressibility; fair shear strength; may be expansive if subjected to wide fluctuations in moisture content.	Moderate; permeability moderately slow.
Sogn-Rockton loams (SoA, SoB, SoC2, SoD2). (Sogn part; for Rockton part, see Rockton complexes).	Poor	Unsuitable	Severe in subsoil, somewhat elastic, large volume change, thin; slight in substratum, underlain by dolomite bedrock.	Slight; dolomite bedrock near the surface.	Very severe; if this soil is used for the filter field for a septic tank, contamination of the ground water probable because of the underlying fissured dolomite.

the soils of Pierce County, Wis., for engineering—Continued

Limitations for—Continued						Factors that influence agricultural drainage	Corrosion potential for conduits
Farm ponds		Irrigation	Terraces and diversions	Grassed waterways			
Reservoir area	Embankments						
Slight; pervious.	Slight; semipervious; medium stability and large volume change; substratum has high shrink-swell potential.	Moderate; moderate water intake rate and high water-holding capacity; drainage required before irrigating.	Moderate; stones and wetness may hinder construction.	Moderate; wetness and stones may hinder construction.		Moderately slow permeability; subsurface drainage beneficial.	Moderate for metal; low for concrete.
Slight; pervious.	Slight; impervious; medium to low stability; large volume change; shale substratum has high shrink-swell potential.	Moderate; moderate water intake rate and moderate water-holding capacity.	Moderate; bedrock near the surface may hinder construction.	Slight; good where bedrock is not exposed and the slopes are no steeper than 12 percent; fair where the slopes are steeper than 12 percent.		Moderately slow permeability; present drainage adequate.	Moderate for metal; low for concrete.
Slight; impervious; has seasonal high water table; suitable for dugout ponds.	Slight; impervious; medium to low stability; large volume change; shale substratum has high shrink-swell potential.	Severe; high water-holding capacity; adequate drainage difficult to obtain.	Severe; shale bedrock near the surface can hinder construction of terraces.	Moderate; adequate seedbed difficult to establish in the clayey subsoil.		Moderately slow permeability in subsoil; slow permeability in substratum; has seasonally high water table; surface drainage needed.	Moderate for metal; low for concrete.
Slight; pervious.	Moderate; semipervious; medium stability and large volume change; substratum susceptible to piping.	Slight; moderately high water intake rate and moderately high water-holding capacity.	Slight; no limiting factors.	Slight where the slopes are no steeper than 12 percent; moderately erodible; fair where the slopes are steeper than 12 percent.		Moderately slow permeability; present drainage. adequate.	Low for metal and concrete.
Very severe; pervious.	Very severe; semipervious; medium stability; moderate volume change and moderate shrink-swell potential.	Very severe; moderate water intake rate and low water-holding capacity.	Very severe; stones and bedrock may hinder construction.	Slight where bedrock is not exposed and the slopes are no steeper than 12 percent; severe where the slopes are steeper than 12 percent.		Moderate permeability; present drainage adequate.	Low to moderate for metal; low for concrete.

TABLE 5.—*Suitability, limitations, and characteristics of*

Soil series or soil type	Suitability as a source of—		Limitations for—		
	Topsoil	Sand and gravel	Subgrade for highways	Foundations for low buildings	Sewage disposal
Sparta loamy sand (SpA, SpB, SpB2, SpC2).	Surface layer poor, thick, dark colored, droughty; subsoil unsuitable, droughty; soil erodible by wind.	Substratum consists of poorly graded sand.	Slight in substratum; stable under wheel loads when damp; no volume change; suitable for all types of pavement when confined.	Slight; good shear strength; very low compressibility; no volume change on wetting; if wet, may liquefy during excavation.	Slight; soil material is free draining throughout the entire profile.
Spencer silt loam (SrA, SrB, SrB2, SrC2).	Surface layer good; subsoil fair, thick.	Unsuitable	Severe in subsoil, somewhat unstable at all moisture contents; slight in substratum, high in stability and little volume change when wet.	Slight; good shear strength; low compressibility; good bearing capacity; easy to compact.	Generally moderate, but severe where drainage approaches somewhat poor; silty material can infiltrate into the drainpipes and gravel filter beds.
Steep stony and rocky land (StF).	Surface layer fair, thin; subsoil unsuitable, stony.	Unsuitable	Slight; contains indurated bedrock.	Slight; underlain by indurated bedrock.	Very severe; too steep
Stronghurst silt loam, benches (SuA).	Surface layer good; subsoil fair to poor, thick; in places subsoil is sandy in lower part.	Substratum fair to poor; consists of poorly graded sand that contains lenses of silty material.	Very severe in subsoil, extremely high volume change, elastic; very severe in substratum; substratum generally unstable at all moisture contents.	Severe; highly susceptible to frost heave and subsequent loss of bearing capacity; saturation can cause loss of cohesion and result in settling; has fair shear strength; subject to liquefaction.	Severe, has fluctuating water table; can liquefy when agitated and flow into drainpipes and gravel filter beds.
Tell silt loam (TeA, TeB2).	Surface layer good; subsoil fair to poor; in places subsoil is sandy in lower part.	Substratum good; it consists of poorly graded sand but contains some fines in places.	Very severe in subsoil; large volume change and loss of bearing capacity when wet; very severe in substratum; no volume change on wetting; suitable for all pavement types when confined.	Severe; has good shear strength: very low compressibility; no volume change on wetting; liquefies if worked while wet.	Moderate; free draining at a depth of 2 to 3 feet.
Terrace escarpments, loamy (Tl).	Requires on-site investigation.	Fair; contains well-graded sand in places.	Slight both in subsoil and in substratum; only small volume change, and change in volume does not produce severe distortion in pavement.	Slight; has moderately low compressibility and fair shear strength.	Very severe; has steep slopes.

See footnote at end of table.

the soils of Pierce County, Wis., for engineering—Continued

Limitations for—Continued						Factors that influence agricultural drainage	Corrosion potential for conduits
Farm ponds		Irrigation	Terraces and diversions	Grassed waterways			
Reservoir area	Embankments						
Very severe; very pervious.	Severe; pervious; high stability and small volume change.	Moderate; very rapid water intake rate and very low water-holding capacity; subject to wind erosion.	Very severe; soil material sandy throughout profile; highly erodible.	Moderate where the slopes are no steeper than 6 percent; a cover of plants difficult to establish and maintain; poor where the slopes are steeper than 6 percent; highly erodible.	Very rapid permeability; present drainage excessive.	Low for metal and concrete.
Slight; pervious	Slight; impervious; subsoil has medium stability and large volume change; substratum has high stability and small volume change; stony in places.	Moderate; slow water intake rate and high water-holding capacity.	Slight; no limiting factors.	Slight; no limiting factors.	Moderate permeability; surface drainage beneficial in places.	Low for metal; low to moderate for concrete.
(1)	(1)	(1)	(1)	(1)	(1)	Low for metal and concrete.
Slight; semipervious.	Slight; semipervious; has medium stability and large volume change.	Moderate; slow to moderate water intake rate and high water-holding capacity; requires drainage before irrigating.	Slight; wetness may hinder construction.	Slight; wetness may hinder construction.	Slow permeability; subsurface and surface drainage needed.	Low for metal; moderate for concrete.
Moderate; pervious	Moderate; semipervious; subsoil has medium stability, large volume change; substratum has high stability, small volume change; susceptible to piping.	Slight; moderate water intake rate and moderate water-holding capacity.	Slight; sandy substratum highly erodible.	Slight; suitable where sand substratum is not exposed and the slopes are no steeper than 12 percent; fair where the slopes are steeper than 12 percent.	Moderate permeability; present drainage adequate.	Low for metal and concrete.
(1)	(1)	(1)	(1)	(1)	(1)	Low for metal and concrete.

TABLE 5.—*Suitability, limitations, and characteristics of*

Soil series or soil type	Suitability as a source of—		Limitations for—		
	Topsoil	Sand and gravel	Subgrade for highways	Foundations for low buildings	Sewage disposal
Terrace escarpments, sandy (Ts).	Material near the surface and in the underlying material fair to poor; sandy and droughty.	Good; contains deposits of well-graded sand.	Slight in subsoil and substratum; good stability and only small volume change when wet; may need to be confined.	Slight; has low compressibility and good to fair shear strength; no volume change when content of moisture changes.	Very severe; has steep slopes.
Terril loam (Tx)	Surface layer good; thick, dark colored; subsoil good to fair, thick.	Unsuitable	Severe in subsoil and substratum; somewhat unstable at all moisture contents; has low bearing capacity when wet.	Severe; highly susceptible to frost heave and loss of bearing strength on thawing; liquefies when saturated; has fair shear strength, and moderate compressibility.	Very severe; subject to periodic overflow; filter fields do not function if they are flooded.
Vlasaty silt loam (VaB, VaB2, VaC, VaC2).	Surface layer good; subsoil fair to poor; subsoil clayey and plastic in places.	Unsuitable	Severe both in subsoil and substratum; moderately large volume change and loss of bearing capacity when wet.	Moderate; low compressibility; good to fair shear strength; easy to compact.	Severe; slight fluctuation of water table; slowly permeable.
Waukegan silt loam (WaA, WaB).	Surface layer good; thick, dark colored; subsoil fair to poor; lower part of subsoil gravelly in places.	Good; substratum consists of poorly graded sand; has some fines in places.	Moderate in subsoil, moderately small volume change and moderately low bearing capacity when wet; slight in substratum, substratum highly stable.	Slight; good shear strength; very low compressibility; no volume change on wetting and drying.	Moderate; free draining below a depth of 2 to 3 feet.
Whalan silt loam (WhA, WhB, WhB2, WhC, WhC2, WhD, WhD2, WhD3, WhE, WhE2).	Surface layer good; subsoil fair to poor, thin over bedrock.	Unsuitable	Slight in subsoil, moderate volume change and low bearing capacity when wet; slight in substratum; substratum underlain by limestone bedrock.	Slight; underlain by limestone bedrock.	Severe; both soil material and fissured dolomitic bedrock moderately permeable.
Worthen silt loam (Wn).	Surface layer good, thick, dark colored; subsoil good to fair, thick.	Unsuitable	Severe both in subsoil and substratum; somewhat unstable at all moisture contents; low bearing capacity when wet.	Severe; highly susceptible to frost heave and loss of bearing strength on thawing; liquefies when saturated; fair shear strength; moderate compressibility.	Severe; subject to periodic overflow; filter fields will not operate when flooded.

See footnote at end of table.

the soils of Pierce County, Wis., for engineering—Continued

Limitations for—Continued						Factors that influence agricultural drainage	Corrosion potential for conduits
Farm ponds		Irrigation	Terraces and diversions	Grassed waterways			
Reservoir area	Embankments						
(1)	(1)	(1)	(1)	(1)		(1)	Low for metal and concrete.
Moderate; pervious.	Moderate; semipervious; medium to low stability; medium volume change.	Moderate; moderate water intake rate and high water-holding capacity; needs protection from stream overflow.	Slight; good for diversions; terraces not needed, because of nearly level relief and hazard of flooding.	Slight; no limiting factors.		Moderate permeability; subject to stream overflow; present drainage adequate.	Moderate for metal; low for concrete.
Slight; pervious.	Slight; impervious; medium stability; large volume change.	Moderate; moderate water intake rate and high water-holding capacity.	Slight; stones and wetness may hinder construction.	Slight; stones may hinder construction.		Moderate permeability; present drainage adequate.	Low to moderate for metal; low for concrete.
Moderate; pervious.	Moderate; semipervious; medium stability and medium volume change in subsoil; high stability and small volume change in substratum.	Slight; moderate water intake rate and moderate water-holding capacity.	Slight; substratum is sandy; highly erodible.	Slight; suitable where sandy substratum is not exposed.		Moderate permeability; present drainage adequate.	Low for metal and concrete.
Moderate; pervious.	Moderate; pervious; subsoil has medium stability and large volume change; bedrock near the surface.	Moderate; moderate water intake and moderate water-holding capacity.	Moderate; stones and bedrock may hinder construction.	Slight where bedrock is not exposed and the slopes are no steeper than 12 percent; moderate where the slopes are steeper than 12 percent.		Moderate permeability; present drainage adequate.	Low to moderate for metal; low for concrete.
Moderate; pervious.	Moderate; semipervious; low stability and small volume change.	Slight; moderate water intake rate and high water-holding capacity; protection from stream overflow needed in places.	Slight for diversions; terraces not needed; hazard of flooding.	Slight; no limiting factors.		Moderate permeability; present drainage adequate; subject to overflow.	Moderate for metal; low for concrete.

TABLE 5.—*Suitability, limitations, and characteristics of*

Soil series or soil type	Suitability as a source of—		Limitations for—		
	Topsoil	Sand and gravel	Subgrade for highways	Foundations for low buildings	Sewage disposal
Wykoff loam (WoB, WoB2, WoC, WoC2, WoC3, WoD, WoD2, WoD3).	Surface layer good; subsoil fair to poor; in places lower part of subsoil gravelly.	Good; substratum consists of poorly graded gravelly material.	Slight in subsoil; soil material in subsoil good when compacted properly; slight in substratum, highly stable regardless of moisture content, and no volume change when wet.	Slight; high shear strength; negligible compressibility; no volume change on wetting.	Slight; free draining below a depth of 24 to 36 inches.
Wykoff silt loam (WsB, WsB2, WsC2).	Surface layer good; subsoil fair to poor; in places lower part of subsoil gravelly.	Good; substratum consists of poorly graded gravelly material.	Slight in subsoil if soil material compacted properly; slight in substratum, highly stable regardless of moisture content, no volume change when wet.	Slight; high shear strength; negligible compressibility, no volume change on wetting.	Moderate; free draining below a depth of 24 to 36 inches.

[1] Not suitable for agriculture.

however, if the soil material is slowly or very slowly permeable to a depth of a few feet but has a rapidly permeable substratum and a deep water table.

Other characteristics that limit the suitability of a soil for disposing of the effluent from septic tanks are the structural stability, the level of the water table, depth of the soil material over a restricting layer, the kind of underlying material, the susceptibility to stream overflow, the slope, and the proximity of the site to wells, streams, and lakes. A well-developed soil structure that is stable when the soil material is wet greatly enhances the value of the soil for the disposal of effluent from septic tanks. If the soil structure is unstable, on the other hand, the soil slakes down when wet. Then, the soil material becomes less permeable and the rate of infiltration is slowed. As a result, soil material may filter into the tile pipes or into the gravel bed of the filter fields. For a sewage disposal system to work well, the soil permeability should be moderate to rapid, and the rate of percolation should be at least 60 minutes per inch.

A water table that rises to as high as the subsurface tile forces the effluent upward to the surface of the soil. As a result, an ill-smelling, unwholesome bog forms in the filter field. In most soils a layer of soil material 4 feet thick between the level reached by the seasonal water table or between the hard rock and the bottom of the trench or filter bed provides adequate depth for filtering and purifying the effluent from septic tanks.

Generally, where the slopes are steeper than 10 percent, filter fields are difficult to lay out and construct and seepage beds are impractical. Where the slopes are very steep, the effluent is likely to flow laterally and seep out on the surface.

Table 5 also gives interpretations of engineering properties of the major soils for specified agricultural uses. Limitations both for reservoir areas and for embankments are given for the development of farm ponds. Soil features that influence limitations for reservoirs and embankments for farm ponds are the height of the water table, permeability, the presence of stones or depth to bedrock, strength and stability of the soil material. shrink-swell potential, and the content of organic matter.

For irrigation, some of the characteristics of the soils that are considered in evaluating limitations are the depth of the soil, water-holding capacity, permeability, natural drainage, and the rate of intake of water. Where sprinkler irrigation is planned, strong slopes are less of a limitation than where a gravitational system is to be used.

Table 5 gives features of the soils that determine limitations for terraces and diversions. Suitability to terraces and diversions is based mainly on the stability, texture, and thickness of the soil material; on the number of stones in the soil or bedrock near the surface; and on the topography. Where the slopes are greater than 12 percent, broad base terraces are not suitable. Diversions, however, can be used on these steeper slopes.

Suitability of the soils for grassed waterways is based mainly on the stability, texture, and thickness of the soil material. Other limitations that make a soil unsuitable for grassed waterways are steep slopes and difficulty in establishing and maintaining a good cover of plants.

the soils of Pierce County, Wis., for engineering—Continued

Limitations for—Continued					Factors that influence agricultural drainage	Corrosion potential for conduits
Farm ponds		Irrigation	Terraces and diversions	Grassed waterways		
Reservoir area	Embankments					
Moderate; pervious	Moderate; semipervious; medium to high stability; small volume change.	Moderate: moderate water intake rate and moderate water-holding capacity.	Slight; sandy and gravelly substratum highly erodible.	Slight where the gravel substratum is not exposed and the slopes are no steeper than 12 percent; moderate where the slopes are steeper than 12 percent.	Moderate permeability; present drainage adequate.	Low for metal and concrete.
Moderate; pervious	Moderate; semipervious; subsoil has low stability, large volume change; substratum has high stability, small volume change.	Moderate; moderate water intake rate and moderate water-holding capacity.	Slight; no limiting factors.	Slight where the gravel substratum is not exposed and the slopes are no steeper than 12 percent; moderate where the slopes are steeper than 12 percent.	Moderate permeability; present drainage adequate.	Low for metal and concrete.

Agricultural drainage is affected by the rate at which water moves into and through the soil, by the presence of a restricting layer, by the depth to the water table, and by the topographic position. In table 5 both surface and subsurface drainage are considered.

Table 5 also shows the corrosion potential of the soils for metal pipes laid underground and for concrete conduits. The corrosion potential of these soils for conduits is closely related to the soil reaction, drainage, and electrical conductivity of the saturation extract. Most conduits are laid in the lower part of the soil material or in the underlying material. Generally, poor aeration and a high pH value, high rate of electrical conductivity, and a high content of moisture are characteristic of soils that are corrosive to metal conduits. Soils that have a low pH value are the most corrosive to concrete conduits. For either metal or concrete conduits, corrosion takes place more rapidly when the content of moisture is high.

Descriptions of the Soils

This section describes the soil series and mapping units of Pierce County. The acreage and proportionate extent of each mapping unit are given in table 6.

The procedure in this section is first to describe the soil series and then the mapping units in the series. Thus, to get full information on any one mapping unit, it is necessary to read the description of that unit and also the description of the soil series to which it belongs. As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. For example, Steep stony and rocky land is a miscellaneous land type and does not belong to a soil series; nevertheless, it, and the other land types in the county, are listed in alphabetic order along with the series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit are the capability unit and woodland suitability group in which the mapping unit has been placed. The pages on which each capability unit and woodland suitability group are described can be found by referring to the "Guide to Mapping Units" at the back of this survey.

Soil scientists, engineers, students, and others who want detailed descriptions of the soil series should turn to the section "Genesis, Morphology, and Classification of Soils." Many terms used in the soil descriptions and in other sections are defined in the Glossary and Soil Survey Manual (*6*).

Adrian Series

The Adrian series consists of nearly level soils that were derived mostly from the remains of plants. These soils have formed under water in the partly decomposed remains of reeds, grasses, sedges, and other nonwoody plants that tolerate a large amount of water. They are underlain by sand at a depth of 18 to 40 inches. These soils are in slight depressions and on low stream terraces and flood plains. They are very poorly drained. The

TABLE 6.—*Approximate acreage and proportionate extent of the soils mapped*

Soils	Area	Extent
	Acres	*Percent*
Adrian muck	86	(1)
Alluvial land, loamy, nearly level	8, 874	2. 4
Alluvial land, loamy, gently sloping	1, 562	. 4
Alluvial land, sandy	1, 996	. 5
Alluvial land, wet	3, 467	. 9
Almena silt loam, 0 to 2 percent slopes	160	(1)
Almena silt loam, 2 to 6 percent slopes	393	. 1
Almena silt loam, 2 to 6 percent slopes, moderately eroded	652	. 2
Antigo silt loam, 0 to 2 percent slopes	422	. 1
Antigo silt loam, 2 to 6 percent slopes	903	. 2
Antigo silt loam, 2 to 6 percent slopes, moderately eroded	354	(1)
Arenzville silt loam	4, 397	1. 2
Arland loam, 2 to 6 percent slopes	1, 745	. 5
Arland loam, 6 to 12 percent slopes, moderately eroded	649	. 2
Auburndale silt loam	3, 283	. 9
Boone fine sand, 12 to 35 percent slopes, eroded	1, 673	. 4
Boone loamy fine sand, 2 to 6 percent slopes, eroded	328	(1)
Boone loamy fine sand, 6 to 12 percent slopes, eroded	782	. 2
Burkhardt loam, 0 to 2 percent slopes	107	(1)
Burkhardt sandy loam, 0 to 2 percent slopes	479	. 1
Burkhardt sandy loam, 2 to 6 percent slopes	668	. 2
Chaseburg silt loam, 0 to 2 percent slopes	891	. 2
Chaseburg silt loam, 2 to 6 percent slopes	553	. 1
Chetek sandy loam, 2 to 6 percent slopes	134	(1)
Chetek sandy loam, 12 to 20 percent slopes, moderately eroded	194	(1)
Clyde silt loam	1, 383	. 4
Dakota loam, 0 to 2 percent slopes	918	. 2
Dakota loam, 2 to 6 percent slopes	1, 736	. 5
Dakota loam, 6 to 12 percent slopes, moderately eroded	92	(1)
Dakota loam, rock substratum, 0 to 2 percent slopes	85	(1)
Dakota loam, rock substratum, 2 to 6 percent slopes, eroded	143	(1)
Dakota loam, loamy substratum, 0 to 2 percent slopes	257	(1)
Dakota loam, loamy substratum, 2 to 6 percent slopes	478	. 1
Dakota sandy loam, 0 to 2 percent slopes	101	(1)
Dakota sandy loam, 2 to 6 percent slopes	954	. 3
Derinda silt loam, 0 to 2 percent slopes	244	(1)
Derinda silt loam, 2 to 6 percent slopes	1, 191	. 3
Derinda silt loam, 2 to 6 percent slopes, moderately eroded	547	. 1
Derinda silt loam, 6 to 12 percent slopes	256	(1)
Derinda silt loam, 6 to 12 percent slopes, moderately eroded	1, 075	. 3
Derinda silt loam, 12 to 20 percent slopes	716	. 2
Derinda silt loam, 12 to 20 percent slopes, moderately eroded	390	. 1
Derinda silt loam, 20 to 30 percent slopes	416	. 1
Derinda silt loam, acid variant, 6 to 12 percent slopes, moderately eroded	273	(1)
Derinda silt loam, acid variant, 12 to 20 percent slopes, eroded	272	(1)
Dickinson fine sandy loam, 2 to 6 percent slopes, moderately eroded	107	(1)
Downs silt loam, 2 to 6 percent slopes	710	. 2
Downs silt loam, 2 to 6 percent slopes, moderately eroded	977	. 3
Downs silt loam, 6 to 12 percent slopes, moderately eroded	1, 131	. 3
Dubuque silt loam, 0 to 2 percent slopes	350	(1)
Dubuque silt loam, 2 to 6 percent slopes	176	(1)
Dubuque silt loam, 2 to 6 percent slopes, moderately eroded	401	. 1
Dubuque silt loam, 6 to 12 percent slopes	615	. 2
Dubuque silt loam, 6 to 12 percent slopes, moderately eroded	2, 446	0. 7
Dubuque silt loam, 12 to 20 percent slopes	2, 651	. 7
Dubuque silt loam, 12 to 20 percent slopes, moderately eroded	4, 206	1. 1
Dubuque silt loam, 20 to 30 percent slopes	1, 828	. 5
Dubuque silt loam, 20 to 30 percent slopes, moderately eroded	842	. 2
Dubuque silt loam, 30 to 40 percent slopes	394	. 1
Dubuque soils, 2 to 6 percent slopes, severely eroded	177	(1)
Dubuque soils, 6 to 12 percent slopes, severely eroded	640	. 2
Dubuque soils, 12 to 20 percent slopes, severely eroded	1, 276	. 3
Dunbarton silt loam, 2 to 6 percent slopes	222	(1)
Dunbarton silt loam, 2 to 6 percent slopes, moderately eroded	257	(1)
Dunbarton silt loam, 6 to 12 percent slopes	452	. 1
Dunbarton silt loam, 6 to 12 percent slopes, moderately eroded	663	. 2
Dunbarton silt loam, 12 to 20 percent slopes	1, 259	. 3
Dunbarton silt loam, 12 to 20 percent slopes, moderately eroded	1, 510	. 4
Dunbarton silt loam, 20 to 30 percent slopes	2, 602	. 7
Dunbarton silt loam, 20 to 30 percent slopes, moderately eroded	883	. 2
Dunbarton complex, 6 to 12 percent slopes	388	. 1
Dunbarton complex, 6 to 12 percent slopes, moderately eroded	228	(1)
Dunbarton complex, 12 to 20 percent slopes	1, 223	. 3
Dunbarton complex, 12 to 20 percent slopes, moderately eroded	2, 057	. 5
Dunbarton complex, 20 to 30 percent slopes	1, 770	. 5
Dunbarton complex, 20 to 30 percent slopes, moderately eroded	852	. 2
Edith soils, 6 to 12 percent slopes, eroded	148	(1)
Edith soils, 12 to 20 percent slopes	959	. 3
Edith soils, 12 to 20 percent slopes, moderately eroded	1, 137	. 3
Edith soils, 20 to 30 percent slopes	1, 092	. 3
Edith-Wykoff soils, 6 to 12 percent slopes, eroded	202	(1)
Edith-Wykoff soils, 12 to 20 percent slopes, eroded	476	. 1
Edith-Wykoff soils, 12 to 20 percent slopes, severely eroded	119	(1)
Edith-Wykoff soils, 20 to 30 percent slopes	272	(1)
Fayette silt loam, benches, 0 to 2 percent slopes	351	(1)
Fayette silt loam, benches, 2 to 6 percent slopes	750	. 2
Fayette silt loam, benches, 6 to 12 percent slopes, moderately eroded	127	(1)
Floyd silt loam, 2 to 6 percent slopes	1, 050	. 3
Freeon silt loam, 2 to 6 percent slopes, moderately eroded	80	(1)
Freeon silt loam, 6 to 12 percent slopes, moderately eroded	114	(1)
Freer silt loam	323	(1)
Gale silt loam, 2 to 6 percent slopes	367	(1)
Gale silt loam, 2 to 6 percent slopes, moderately eroded	2, 049	. 5
Gale silt loam, 6 to 12 percent slopes, eroded	670	. 2
Gale silt loam, 12 to 20 percent slopes, moderately eroded	492	. 1
Gale silt loam, thin solum variant, 6 to 12 percent slopes, eroded	321	(1)
Gale silt loam, thin solum variant, 12 to 20 percent slopes	323	(1)
Gale silt loam, thin solum variant, 12 to 20 percent slopes, moderately eroded	295	(1)
Gale silt loam, thin solum variant, 20 to 30 percent slopes	342	(1)
Halder loam, 0 to 2 percent slopes	295	(1)

See footnote at end of table.

TABLE 6.—*Approximate acreage and proportionate extent of the soils mapped*—Continued

Soils	Area	Extent	Soils	Area	Extent
	Acres	*Percent*		*Acres*	*Percent*
Halder loam, sandy substratum, 0 to 3 percent slopes	208	(1)	Otterholt silt loam, 6 to 12 percent slopes, moderately eroded	19, 634	5. 2
Hesch loam, loamy substratum, 2 to 6 percent slopes	161	(1)	Otterholt silt loam, 6 to 12 percent slopes, severely eroded	1, 095	. 3
Hesch loam, loamy substratum, 2 to 6 percent slopes, moderately eroded	318	(1)	Otterholt silt loam, 12 to 20 percent slopes, moderately eroded	808	. 2
Hesch loam, loamy substratum, 6 to 12 percent slopes, moderately eroded	204	(1)	Plainfield loamy sand, 0 to 2 percent slopes	256	(1)
Hesch loam, loamy substratum, 12 to 20 percent slopes, moderately eroded	189	(1)	Plainfield loamy sand, 2 to 6 percent slopes	1, 198	. 3
Hesch fine sandy loam, loamy substratum, 2 to 6 percent slopes, moderately eroded	688	. 2	Plainfield loamy sand, 2 to 6 percent slopes, eroded	581	. 2
Hesch fine sandy loam, loamy substratum, 6 to 12 percent slopes, moderately eroded	942	. 3	Plainfield loamy sand, 6 to 12 percent slopes	1, 097	. 3
Hesch fine sandy loam, loamy substratum, 12 to 20 percent slopes, eroded	309	(1)	Plainfield loamy sand, 6 to 12 percent slopes, eroded	435	. 1
Hixton fine sandy loam, 6 to 12 percent slopes, moderately eroded	232	(1)	Port Byron silt loam, 0 to 2 percent slopes	423	. 1
Hixton fine sandy loam, 12 to 20 percent slopes, moderately eroded	524	. 1	Port Byron silt loam, 2 to 6 percent slopes	408	. 1
Hixton fine sandy loam, loamy substratum, 2 to 6 percent slopes	393	. 1	Port Byron silt loam, 6 to 12 percent slopes, moderately eroded	92	(1)
Hixton fine sandy loam, loamy substratum, 2 to 6 percent slopes, moderately eroded	361	(1)	Racine silt loam, 2 to 6 percent slopes	188	(1)
Hixton fine sandy loam, loamy substratum, 6 to 12 percent slopes	363	(1)	Racine silt loam, 2 to 6 percent slopes, moderately eroded	165	(1)
Hixton fine sandy loam, loamy substratum, 6 to 12 percent slopes, moderately eroded	870	. 2	Racine silt loam, 6 to 12 percent slopes, moderately eroded	165	(1)
Hixton fine sandy loam, loamy substratum, 12 20 percent slopes	180	(1)	Renova silt loam, 0 to 2 percent slopes	595	. 2
Hixton fine sandy loam, loamy substratum, 12 to 20 percent slopes, moderately eroded	664	. 2	Renova silt loam, 2 to 6 percent slopes	4, 724	1. 3
Hixton fine sandy loam, loamy substratum, 20 to 30 percent slopes	261	(1)	Renova silt loam, 2 to 6 percent slopes, moderately eroded	7, 871	2. 1
Hixton loam, loamy substratum, 2 to 6 percent slopes	463	. 1	Renova silt loam, 6 to 12 percent slopes	1, 915	. 5
Hixton loam, loamy substratum, 6 to 12 percent slopes, moderately eroded	437	. 1	Renova silt loam, 6 to 12 percent slopes, moderately eroded	8, 657	2. 3
Hixton loam, loamy substratum, 12 to 20 percent slopes, eroded	203	(1)	Renova silt loam, 6 to 12 percent slopes, severely eroded	537	. 1
Lamont very fine sandy loam, 2 to 6 percent slopes, moderately eroded	62	(1)	Renova silt loam, 12 to 20 percent slopes	937	. 2
Lamont very fine sandy loam, 6 to 12 percent slopes, moderately eroded	69	(1)	Renova silt loam, 12 to 20 percent slopes, moderately eroded	1, 315	. 4
Lamont very fine sandy loam, 12 to 20 percent slopes, moderately eroded	85	(1)	Renova silt loam, 12 to 20 percent slopes, severely eroded	435	. 1
Lawler loam, 0 to 3 percent slopes	696	. 2	Renova fine sandy loam, sandy variant, 2 to 6 percent slopes, eroded	278	(1)
Lawler silt loam, 0 to 2 percent slopes	453	. 1	Renova fine sandy loam, sandy variant, 6 to 12 percent slopes, eroded	179	(1)
Lawler silt loam, 2 to 6 percent slopes	213	(1)	Renova fine sandy loam, sandy variant, 12 to 20 percent slopes, eroded	87	(1)
Meridian loam, 0 to 2 percent slopes	122	(1)	Riverwash	1, 508	. 4
Meridian loam, 2 to 6 percent slopes	592	. 2	Rockton complex, 2 to 6 percent slopes	292	(1)
Onamia loam, 0 to 2 percent slopes	226	(1)	Rockton complex, 6 to 12 percent slopes, moderately eroded	127	(1)
Onamia loam, 2 to 6 percent slopes	396	. 1	Rozetta silt loam, benches, 0 to 2 percent slopes	290	(1)
Onamia loam, 2 to 6 percent slopes, moderately eroded	286	(1)	Rozetta silt loam, benches, 2 to 6 percent slopes	160	(1)
Onamia loam, 6 to 12 percent slopes, moderately eroded	271	(1)	Sable silt loam	104	(1)
Onamia loam, 12 to 20 percent slopes, moderately eroded	240	(1)	Santiago silt loam, 2 to 6 percent slopes	612	. 2
Onamia sandy loam, 2 to 6 percent slopes	143	(1)	Santiago silt loam, 2 to 6 percent slopes, moderately eroded	1, 287	. 3
Onamia sandy loam, 6 to 12 percent slopes, moderately eroded	175	(1)	Santiago silt loam, 6 to 12 percent slopes, moderately eroded	546	. 1
Orion silt loam	1, 966	. 5	Sargeant silt loam, 0 to 2 percent slopes	645	. 2
Ostrander silt loam, 0 to 2 percent slopes	78	(1)	Sargeant silt loam, 2 to 6 percent slopes	7, 651	0. 2
Ostrander silt loam, 2 to 6 percent slopes	265	(1)	Sargeant silt loam, 2 to 6 percent slopes, moderately eroded	2, 379	. 6
Ostrander silt loam, 2 to 6 percent slopes, moderately eroded	501	. 1	Sargeant silt loam, 6 to 12 percent slopes	247	(1)
Ostrander silt loam, 6 to 12 percent slopes, moderately eroded	354	(1)	Sargeant silt loam, 6 to 12 percent slopes, moderately eroded	190	(1)
Otterholt silt loam, 2 to 6 percent slopes	1, 597	. 4	Schapville silt loam, 6 to 12 percent slopes	232	(1)
Otterholt silt loam, 2 to 6 percent slopes, moderately eroded	14, 820	3. 9	Schapville silt loam, 6 to 12 percent slopes, moderately eroded	295	(1)
Otterholt silt loam, 6 to 12 percent slopes	3, 002	. 8	Schapville silt loam, 12 to 20 percent slopes, moderately eroded	348	(1)
			Schapville silt loam, 20 to 30 percent slopes, eroded	133	(1)
			Schapville silt loam, wet subsoil variant, 2 to 6 percent slopes, eroded	229	(1)
			Seaton silt loam, 2 to 6 percent slopes	7, 210	1. 9
			Seaton silt loam, 2 to 6 percent slopes, moderately eroded	18, 075	4. 8

See footnote at end of table.

TABLE 6.—*Approximate acreage and proportionate extent of the soils mapped*—Continued

Soils	Area	Extent
	Acres	*Percent*
Seaton silt loam, 6 to 12 percent slopes	4, 380	1. 2
Seaton silt loam, 6 to 12 percent slopes, moderately eroded	37, 170	9. 9
Seaton silt loam, 6 to 12 percent slopes, severely eroded	1, 552	. 4
Seaton silt loam, 12 to 20 percent slopes	4, 862	1. 3
Seaton silt loam, 12 to 20 percent slopes, moderately eroded	14, 334	3. 8
Seaton silt loam, 12 to 20 percent slopes, severely eroded	3, 388	. 9
Seaton silt loam, 20 to 30 percent slopes	1, 717	. 5
Seaton silt loam, 20 to 30 percent slopes, moderately eroded	1, 114	. 3
Sogn-Rockton loams, 0 to 2 percent slopes	88	[1]
Sogn-Rockton loams, 2 to 6 percent slopes	156	[1]
Sogn-Rockton loams, 6 to 12 percent slopes, moderately eroded	68	[1]
Sogn-Rockton loams, 12 to 20 percent slopes, moderately eroded	272	[1]
Sparta loamy sand, 0 to 2 percent slopes	1, 519	. 4
Sparta loamy sand, 2 to 6 percent slopes	870	. 2
Sparta loamy sand, 2 to 6 percent slopes, eroded	567	. 2
Sparta loamy sand, 6 to 12 percent slopes, eroded	464	. 1
Spencer silt loam, 0 to 2 percent slopes	309	[1]
Spencer silt loam, 2 to 6 percent slopes	3, 825	1. 0
Spencer silt loam, 2 to 6 percent slopes, moderately eroded	5, 140	1. 4
Spencer silt loam, 6 to 12 percent slopes, moderately eroded	4, 275	1. 1
Steep stony and rocky land	23, 667	6. 3
Stronghurst silt loam, benches, 0 to 2 percent slopes	70	[1]
Tell silt loam, 0 to 2 percent slopes	340	[1]
Tell silt loam, 2 to 6 percent slopes, eroded	430	. 1
Terrace escarpments, loamy	1, 500	. 4
Terrace escarpments, sandy	2, 934	. 8
Terril loam	466	. 1
Vlasaty silt loam, 2 to 6 percent slopes	2, 756	. 7
Vlasaty silt loam, 2 to 6 percent slopes, moderately eroded	6, 048	1. 6
Vlasaty silt loam, 6 to 12 percent slopes	447	0. 1
Vlasaty silt loam, 6 to 12 percent slopes, moderately eroded	2, 615	. 7
Waukegan silt loam, 0 to 2 percent slopes	2, 816	. 8
Waukegan silt loam, 2 to 6 percent slopes	1, 926	. 5
Whalan silt loam, 0 to 2 percent slopes	122	[1]
Whalan silt loam, 2 to 6 percent slopes	1, 243	. 3
Whalan silt loam, 2 to 6 percent slopes, moderately eroded	1, 245	. 3
Whalan silt loam, 6 to 12 percent slopes	525	. 1
Whalan silt loam, 6 to 12 percent slopes, moderately eroded	2, 742	. 7
Whalan silt loam, 12 to 20 percent slopes	704	. 2
Whalan silt loam, 12 to 20 percent slopes, moderately eroded	3, 049	. 8
Whalan silt loam, 12 to 20 percent slopes, severely eroded	230	[1]
Whalan silt loam, 20 to 30 percent slopes	465	. 1
Whalan silt loam, 20 to 30 percent slopes, moderately eroded	228	[1]
Worthen silt loam	85	[1]
Wykoff loam, 2 to 6 percent slopes	757	. 2
Wykoff loam, 2 to 6 percent slopes, moderately eroded	1, 894	. 5
Wykoff loam, 6 to 12 percent slopes	1, 832	. 5
Wykoff loam, 6 to 12 percent slopes, moderately eroded	3, 696	1. 0
Wykoff loam, 6 to 12 percent slopes, severely eroded	381	. 1
Wykoff loam, 12 to 20 percent slopes	1, 048	. 3
Wykoff loam, 12 to 20 percent slopes, moderately eroded	931	. 2
Wykoff loam, 12 to 20 percent slopes, severely eroded	285	[1]
Wykoff silt loam, 2 to 6 percent slopes	527	. 1
Wykoff silt loam, 2 to 6 percent slopes, moderately eroded	867	. 2
Wykoff silt loam, 6 to 12 percent slopes, eroded	156	[1]
Total	378, 240	100. 0

[1] Less than 0.1 percent.

water table is near the surface throughout most of the year.

Muck and peat, the two organic materials from which these soils were derived, differ primarily in the degree of decomposition and disintegration of the original plant fibers. Muck has undergone decomposition to the extent that few, if any, of the original plant fibers can now be identified. It is less spongy and less fibrous than peat, lacks the thick, matted plates and blocks that are characteristic of peat that has been exposed to air, and is black and has a greasy feel when wet. In places muck has a fairly high content of mineral soil material.

Representative profile of Adrian muck:

0 to 4 inches, black, friable muck.
4 to 29 inches, black, friable peaty muck.
29 to 50 inches, light brownish-gray, loose sand.

In the place where this profile occurs, the water table is generally at a depth of about 30 inches.

Adrian soils have moderately rapid permeability, but high available moisture capacity. The depth to which roots penetrate depends on the depth to the water table; the roots generally extend to within about 10 inches of the water table. The reaction throughout the profile ranges from mildly alkaline to slightly acid.

Few areas of the Adrian soils have been drained and cultivated. Where these soils have been drained, they are highly desirable for special crops, such as truck crops. All the crops grown on these soils, however, require special management. Where the water table has been lowered by drainage or through other causes, the organic material has decomposed to a greater degree and to a greater depth than in areas where the water table is high. In areas that are cultivated, the organic matter decomposes rapidly.

These soils need protection from fire. Where they are cultivated, they are susceptible to erosion by wind.

Adrian muck (Ad).—This is the only Adrian soil mapped in this county. In places it contains layers, a few inches thick, of fibrous, matted peat. Commonly, a few inches of silty material has been deposited on the surface.

Because this soil occurs in small, scattered areas, it has little value for agriculture. Most of the acreage is in per-

manent pasture, and only a small acreage is in field crops. This soil is suitable for open ditch drainage, and some areas are suitable for tile drainage. The soil is susceptible to wind erosion if it is cultivated, and it needs protection from fire. Where crops are grown, liberal applications of fertilizer, especially potash, are required for good yields. (Capability unit IVw–7, woodland suitability group 10)

Alluvial Land

Alluvial land is a miscellaneous land type made up of light-colored and dark-colored sediments deposited by streams. It is on flood plains and on the bottoms of narrow valleys.

The soil materials in this land type vary widely in texture, and generally, they are layered. The layering is the result of deposition rather than of profile development. The deposits are too recent for soil profiles to have formed. In areas where drainage is poor, the lower part of the soil material is mottled.

This land type is subject to change as the result of periodic overflow. It is stable enough, however, for plants to become established.

Alluvial land, loamy, nearly level (Ae).—This land type is on flood plains of the major streams, on bottom lands of coulees, and in upland drainageways. It consists of alluvial sediments that generally have a texture of sandy loam to silt loam. In some areas, however, the soil material contains sand or gravel, or sand and gravel are on the surface. This land type occurs with Arenzville, Orion, and Huntsville soils.

Where this land type is in slight depressions, it is somewhat poorly drained and has high available moisture capacity. Where it occupies higher areas and has better drainage, the available moisture capacity is correspondingly lower. Crops grown on this land type are subject to damage as the result of overflow.

Where this land type is not flooded too frequently and is accessible to equipment, it is well suited to use for crops. Most of the areas that are not cultivated are used for grazing, and pastures are very good on many of them. Some areas are isolated by sloughs or channels and have been left in trees. Those areas serve as excellent sites for wildlife. (Capability unit IIIw–12, woodland suitability group 1)

Alluvial land, loamy, gently sloping (Ag).—This land type consists of alluvial sediments in coulees, in narrow upland drainageways, and in small plots on alluvial-colluvial fans that are common along the base of bluffs. The areas are generally at a higher elevation than those occupied by Alluvial land, loamy, nearly level. Where this land type occurs on alluvial-colluvial fans, it has fragments of chert, sandstone, and limestone throughout and fragments are common on the surface. In most places this land type is moderately well drained or well drained and is not mottled or is only slightly mottled.

This land type has slightly lower available moisture capacity and better surface drainage than Alluvial land, loamy, nearly level. Also, water does not pond on the surface after the areas are flooded.

Much of the acreage is used for crops. Many of the areas in narrow coulees and upland drainageways, however, do not fit well into the cropping pattern and are used for pasture. The inaccessible areas are left idle; where those areas are wooded, they are managed as woodland and make excellent wildlife areas. (Capability unit IIIw–12, woodland suitability group 1)

Alluvial land, sandy (Ah).—This nearly level land type consists of deep, sandy alluvium on flood plains. The largest acreage is on bottoms of the Mississippi and Rush Rivers. In areas along the Mississippi River, where floodwaters have released coarse-textured sediments, this land type makes up the main banks of the river channel. Near the surface, the land type has a texture of sand or loamy sand. The deeper soil material consists of stratified fine to coarse sand. This land type supports willows, oaks, elms, soft maples, birches, and a sparse cover of bluegrass. Plants that require the greatest amount of moisture grow on the banks of the stream. Plants that are more resistant to drought grow at a greater distance from the stream. This land type occurs with areas of loamy Alluvial lands, but it is coarser textured and better drained than those land types.

This land type is well drained to excessively drained. Because the areas are near streams, however, the water table is at or near the surface for short periods when the level of the stream is high. Because of this temporarily high water table, a few yellow and brown mottles occur in some areas below a depth of 2 to 3 feet. This land type is subject to frequent flooding. At times, the floodwaters remain for long periods, and several inches of sand may be deposited on the surface during those periods. In some places enough sand is deposited to kill the vegetation on the site. The soil material dries out rapidly after the level of the water recedes.

Permeability is rapid, and the available moisture capacity is low. Because the soil material is droughty and has low natural fertility, the growth of plants is limited.

This land type is used mainly for wildlife and trees, but some areas are in permanent pasture. A minor acreage is in crops, but this land has little value for farming. (Capability unit VIIs–9, woodland suitability group 4)

Alluvial land, wet (Al).—This land type is in nearly level areas or in slight depressions on flood plains. It consists of alluvial sediments that range from sandy loam to silt loam in texture. At or near the surface, the sediments range from light to dark in color. The water table remains at or near the surface during most of the year.

Some of the most extensive areas of this land type are on flood plains of the Mississippi River. Others occur on the flood plains of the Rush River, from the mouth of that river to several miles upstream. Smaller areas are on creek bottoms throughout the county. The larger areas along the Mississippi River are commonly dissected by sloughs, oxbows, and extinct stream channels. Those areas are subject to frequent flooding. Some of them remain inundated for several days following a period of high water. During the time when these areas are flooded, additional stream sediments may be deposited, or the channel of the stream may shift to a new course.

Mainly this land type supports bluegrass, marsh grasses, willows, river birches, soft maples, and other plants that tolerate a large amount of water. It is suited to permanent pasture, trees, or use for wildlife habitats. Trees cover all of the most extensive area, which is on

the flood plains of the Mississippi River between Bay City and Diamond Bluff. That tract serves as an excellent area for wildlife. (Capability unit Vw–14, woodland suitability group 9)

Almena Series

This series consists of deep, somewhat poorly drained, silty soils that are nearly level to sloping. These soils are on uplands, mainly in the eastern part of the county. They formed in a thick mantle of windblown silt (loess) over loam till that is yellowish brown.

Representative profile of Almena silt loam:

0 to 8 inches, dark grayish-brown, friable silt loam.
8 to 14 inches, grayish-brown, friable silt loam; few, fine, dark yellowish-brown mottles.
14 to 45 inches, dark-brown, firm silt loam, with bleached silt coats and few, fine, dark-brown mottles.
45 inches +, grayish-brown gritty clay loam till; few, fine, strong-brown mottles.

In most places the Almena soils receive water from the adjacent soils. Surface drainage is medium to slow. Permeability is moderate in the subsoil, but it is slow in the underlying glacial till, and internal drainage is slow in the till. The available moisture capacity is high. These soils are very strongly acid below a depth of about 8 inches. They have moderately high natural fertility, but crops grown on them respond well to applications of lime and fertilizer. The root zone of plants extends deep into the lower part of the subsoil.

These soils are slow to warm up in spring, and lime is required for optimum yields. Drainage is required for some crops to grow successfully. Nevertheless, these soils are fairly easy to cultivate and can be managed fairly easily. Yields are generally high if management is good. In this county the Almena soils are not extensive and are not of great importance for farming.

Almena silt loam, 0 to 2 percent slopes (AmA).—This soil is mainly in nearly level areas or on slightly concave slopes, where it has been subject to little or no erosion. It is adjacent to natural waterways, or the areas are cut by natural waterways. In many places this soil occurs with the Sable soil, which is very poorly drained.

In most places the surface layer is thicker and slightly darker colored than the one in the profile described for the series. Also, the subsoil is more grayish in some places and contains larger, brighter colored mottles.

For optimum yields on this soil, surface drainage or diversions may be required to reduce the amount of runoff that accumulates on the surface. Practically all of the acreage is used for crops. (Capability unit IIw–4, woodland suitability group 7)

Almena silt loam, 2 to 6 percent slopes (AmB).—This soil is on concave slopes similar to those occupied by Almena silt loam, 0 to 2 percent slopes. It has been subject to little or no erosion. The profile is the one described as typical for the series.

This soil has better surface drainage than Almena silt loam, 0 to 2 percent slopes, and ponding is less likely to occur after heavy rains. As a result, the profile is less grayish than that of Almena silt loam, 0 to 2 percent slopes. Also, the mottling is less intensive, although the mottles are darker colored.

Wetness can be reduced by constructing diversions to protect this soil from runoff. Waterways can also be constructed to safely dispose of the excess water. Yields generally increase after the excess water is safely removed. (Capability unit IIw–4, woodland suitability group 7)

Almena silt loam, 2 to 6 percent slopes, moderately eroded (AmB2).—This soil occurs in areas that have been cultivated. It has lost from one-third to two-thirds of its original surface layer through erosion. As a result, the present surface layer is thinner and lighter colored than the original one, and it also contains less organic matter. In some plowed fields, lighter colored patches are apparent where the subsoil is exposed.

This soil is at a slightly lower elevation than the Otterholt and Spencer soils, which generally occupy the highest areas in a pattern of soils. Included with it in mapping are small areas of Almena silt loam, 6 to 12 percent slopes.

The surface layer is lower in content of organic matter and in natural fertility than the surface layers of the other Almena soils, which are only slightly eroded. Suitable practices are needed to control further erosion. Diversions, used to intercept runoff, help to control the excess water and reduce erosion. (Capability unit IIw–4, woodland suitability group 7)

Antigo Series

The Antigo series consists of well-drained, silty soils that are nearly level or gently sloping. These soils are generally underlain by sand and gravel at a depth ranging from 24 to 42 inches. In some places, however, the substratum contains a layer of finer textured material. The Antigo soils are on stream terraces, mainly within the valley of the Kinnickinnic River in the northwestern part of the county. Smaller areas are in the valleys of other streams. In some of the valleys are small areas in which these soils are moderately well drained.

Representative profile of Antigo silt loam:

0 to 7 inches, very dark grayish-brown, friable silt loam.
7 to 12 inches, dark grayish-brown, friable silt loam.
12 to 24 inches, dark yellowish-brown, firm silt loam; pale-brown silt coats.
24 to 28 inches, dark yellowish-brown, firm loam.
28 inches +, dark-brown, loose gravelly sand.

The Antigo soils are moderately permeable, but they are underlain by a substratum that has rapid internal drainage. In general, these soils have fair to moderate available moisture capacity. The available moisture capacity is higher, however, in areas where the substratum contains a layer that is finer textured than typical. Yields of crops are likely to be higher in those areas than in other places. Natural fertility is moderately high. These soils do not contain a layer that restricts the growth of roots. The root zone normally extends downward to the substratum of outwash material, but a few large roots penetrate to a greater depth.

Antigo silt loam, 0 to 2 percent slopes (AnA).—This is a nearly level soil of stream terraces. Its profile is the one described for the Antigo series. Because of the nearly level relief and moderate permeability, little runoff has

taken place. This soil has been subject to little or no erosion, and the hazard of future erosion is slight.

In a few small areas, this soil is moderately well drained. The profile in those areas has the same characteristics as those of the profile described as typical for the series.

This Antigo soil is suited to all of the crops commonly grown in the county. Management practices that conserve water are suggested. (Capability unit IIs-1, woodland suitability group 1)

Antigo silt loam, 2 to 6 percent slopes (AnB).—Runoff is more rapid on this soil than on Antigo silt loam, 0 to 2 percent slopes. Little or no erosion has taken place, but erosion is a slight hazard. The profile is similar to the one described for the series. Because less water infiltrates, this soil is slightly more droughty than Antigo silt loam, 0 to 2 percent slopes.

This soil is well suited to all the locally grown crops, and nearly all of the acreage is used for crops. Yields are generally moderately high. Practices that conserve soil and water are needed, however, for sustained good yields. (Capability unit IIe-2, woodland suitability group 1)

Antigo silt loam, 2 to 6 percent slopes, moderately eroded (AnB2).—In most places this soil has lost from one-third to two-thirds of its original surface layer through erosion. In some spots in plowed fields, however, all of the original surface layer has been lost and the dark-brown subsoil is exposed. The present surface layer is lighter colored than the original one. Also, it is lower in content of organic matter and natural fertility, is in poorer tilth, and takes in less water.

This soil is well suited to all the locally grown crops. All of the acreage is used for crops, but yields are generally lower than on Antigo silt loam, 2 to 6 percent slopes. Practices are needed that control erosion and conserve water. (Capability unit IIe-2, woodland suitability group 1)

Arenzville Series

The Arenzville series consists of nearly level or gently sloping soils that are well drained or moderately well drained. These soils formed in deep, silty alluvium washed from loess-mantled uplands. In their profile a dark-colored buried soil is common at some depth between 24 to 48 inches. Some areas of these soils are on broad flood plains of the major streams in the county. Others are on narrow bottoms along the smaller streams.

Representative profile of Arenzville silt loam:

0 to 9 inches, very dark grayish-brown, friable silt loam.
9 to 31 inches, dark grayish-brown, friable silt loam.
31 to 40 inches, black, very friable silt loam.
40 to 50 inches +, dark grayish-brown, friable silt loam.

The Arenzville soils are moderately permeable and have high available moisture capacity. They generally have neutral reaction, have a deep root zone, and have high natural fertility.

Arenzville silt loam (Ar).—This soil is on flood plains or bottoms along streams. It is the only Arenzville soil mapped in the county. The nearly level relief and the deep, friable surface layer make this soil easy to till. Many of the areas are subject to overflow and streambank cutting.

This soil can be cropped intensively if it is protected from flooding, supplied with plant nutrients, and well managed. Where flooding and streambank cutting are continuing hazards, forage crops can be grown, or this soil can be used for pasture, trees, or wildlife habitats. (Capability unit IIw-11, woodland suitability group 1)

Arland Series

The Arland series consists of moderately deep soils that are well drained. These soils formed in a thin mantle of loamy material over a shallow deposit of glacial till that, in turn, is underlain by weathered sandstone. They commonly occur in areas where soils that formed in glacial till grade to sandy soils of unglaciated areas.

Representative profile of Arland loam:

0 to 10 inches, dark-brown, friable loam.
10 to 13 inches, brown, friable very fine sandy loam.
13 to 24 inches, very dark brown, firm sandy clay loam.
24 to 29 inches, brown, firm sandy loam.
29 inches +, white fine sand containing yellowish-red veins.

The Arland soils are moderately permeable and have moderately rapid internal drainage. They are slightly acid to medium acid and have fair to moderate available moisture capacity and moderately high natural fertility. The root zone of these soils extends downward to the layer of fine sand. Suggested management practices are ones that conserve soil and water.

Arland loam, 2 to 6 percent slopes (AsB).—This is a gently sloping soil on plains in the uplands. Its surface layer is thicker and darker colored than the one in the profile described as representative for the series. Normally, the loamy upper part of the profile is also thicker than the upper part of the profile described as typical. In most places the slopes are between 2 and 4 percent.

Because of its gentle slopes, this soil has not been greatly affected by erosion. It is slightly susceptible to erosion, however, although runoff is rather slow. Droughtiness is a slight hazard.

This soil is deeper over weathered sandstone than the steeper Arland soils. Also, the content of organic matter, natural fertility, and available moisture capacity are higher than in the steeper soils.

This soil is suited to all of the locally grown crops, and nearly all of the acreage is cultivated. Only simple management practices are needed to maintain good tilth. (Capability unit IIe-2, woodland suitability group 1)

Arland loam, 6 to 12 percent slopes, moderately eroded (AsC2).—The profile of this soil is generally shallower over the substratum than the one described for the series, and the surface layer is also thinner. From 4 to 8 inches of the original surface layer has been lost through erosion, and the present surface layer is dark brown. Because this soil is eroded, the present surface layer contains less organic matter, is less fertile, and takes in less water than the original one. Included in mapped areas of this soil are small areas of Arland loam, 6 to 12 percent slopes.

This moderately eroded Arland soil is used for field crops. Because of its reduced capacity to take in water, however, it is rather droughty. Practices that conserve water, as well as practices that control erosion, are re-

quired for optimum yields. Row crops can be grown 1 year in 5 if contour stripcropping is practiced. (Capability unit IIIe-2, woodland suitability group 1)

Auburndale Series

The Auburndale series consists of silty soils that are poorly drained. These soils are in shallow depressions and in drainageways in the uplands. They have formed in 30 to more than 36 inches of silt that is underlain by glacial drift.

Representative profile of Auburndale silt loam:

0 to 8 inches, very dark gray, friable silt loam; few, fine, dark-brown mottles.
8 to 11 inches, gray, friable silt loam; few, fine, dark-brown mottles.
11 to 26 inches, gray, firm silt loam; fine, strong-brown mottles and very dark gray stains are common.
26 to 43 inches, olive-gray silt loam; medium, gray mottles and very dark gray stains are common.
43 to 48 inches, yellowish-brown, friable sandy loam; medium, gray mottles are common.
48 inches +, olive-gray, firm loam; many, medium, yellowish-brown mottles.

The Auburndale soils not only receive moisture from rainfall, but they also receive water that flows onto them from the adjacent slopes. Runoff is very slow. Therefore, much of the water passes through these soils instead of running off. Permeability is moderate in the subsoil, but it is somewhat slower in the underlying till. Internal drainage is slow, and the available moisture capacity is high. In most places the root zone is shallow. It generally extends to a depth of only about 11 inches, but a few tap roots penetrate deeper. The soil reaction ranges from slightly acid to very strongly acid. Wetness and flooding are the hazards associated with these soils. Some drainage is necessary if dependable yields are to be obtained.

Auburndale silt loam (Au).—This is the only Auburndale soil mapped in Pierce County. Its profile is the one described for the series. This soil is nearly level. Therefore, runoff is slow and ponding occurs in some areas after heavy rains.

If field crops are grown, improved surface drainage is needed, or, where practical, tile drainage can be installed. Diverting runoff from the adjacent areas also helps to reduce wetness. Where the water has not been controlled, this soil is suited to grass. (Capability unit IIIw-3, woodland suitability group 7)

Boone Series

The Boone series consists of sandy and droughty soils that formed in coarse-textured material weathered from sandstone. These soils are gently sloping to very steep and are on uplands and valley slopes. In most places where they occur on valley slopes below steep bluffs, they are deep and have fragments of sandstone on the surface and throughout the profile. Where these soils occur in the northwestern part of the county, they have bands of loamy material, ranging from loam to sandy clay loam in texture, at depths below 3 feet. Weathered sandstone underlies these soils at depths ranging from a few inches to several feet. Generally, weathered sandstone is near the surface in areas where the slopes are steep.

Representative profile of Boone loamy fine sand:

0 to 6 inches, dark grayish-brown, very friable loamy fine sand.
6 to 18 inches, yellowish-brown, very friable loamy fine sand.
18 to 42 inches, yellowish-brown, loose fine sand.
42 to 60 inches, yellow, loose fine sand.
60 inches +, pale-brown and yellowish-brown, weakly cemented sandstone.

The Boone soils have very rapid permeability and very low available moisture capacity. Natural fertility is low, and these soils are susceptible to erosion, both by wind and water. They are medium acid below a depth of about 6 inches, but their surface layer is neutral in areas that have been limed. Yields are limited, even though drought-resistant crops are grown.

Boone loamy fine sand, 2 to 6 percent slopes, eroded (BnB2).—This soil has a profile like the one described for the series. It has lost from one-third to two-thirds of its original surface layer through wind and water erosion. Further erosion is a hazard if this soil is not adequately protected. Included in mapped areas of this soil are small areas of Boone loamy fine sand, 2 to 6 percent slopes.

This eroded Boone soil is droughty and is low in natural fertility. Cultivated crops are grown on much of the acreage. Some areas, however, have recently been planted to pine trees, are used for permanent pasture, or have been abandoned for crops and are idle. Where cultivated crops are grown, management practices that conserve moisture and that provide protection from erosion are needed, even for limited yields. (Capability unit IVs-3, woodland suitability group 4)

Boone loamy fine sand, 6 to 12 percent slopes, eroded (BnC2).—This is a sloping soil that has been used for cultivated crops or for seriously overgrazed pasture. In most places it has lost from one-third to two-thirds of its original surface layer through erosion. The cultivated areas contain some lighter colored spots where the underlying material has been exposed by tillage. Included in the areas mapped are small areas of Boone loamy fine sand, 6 to 12 percent slopes.

Droughtiness, lack of fertility, and susceptibility to erosion make Boone loamy fine sand, 6 to 12 percent slopes, eroded, unsuitable for cultivated crops. Because of the generally low returns if cultivated crops are grown, many of the fields are being converted to pasture or to plantations of pines. If this soil is properly managed, limited yields of forage crops can be obtained. This soil is well suited to coniferous trees and supports plants that provide food and cover for wildlife. (Capability unit VIs-3, woodland suitability group 4)

Boone fine sand, 12 to 35 percent slopes, eroded (BfE2).—This is a moderately steep to very steep soil that in most places has lost from one-third to two-thirds of its original surface layer through erosion. It consists of loose, droughty sand and of fragments and outcrops of sandstone. Weathered sandstone bedrock is generally at a depth ranging from only a few inches to more than 5 feet. The profile of this soil differs from the profile described as representative for the series, mainly in having a lighter colored surface layer and in being composed of looser, coarser textured sand. Also, the depth to weathered sandstone bedrock is more variable. Included in mapped areas of this soil are small areas of Boone fine sand, 12 to 35 percent slopes.

This eroded Boone soil is even more droughty and lacking in fertility than the less sloping Boone soils. Some areas have been cultivated, and most of the acreage has been cleared. This soil is suitable for plantings of coniferous trees and for use as areas for wildlife. (Capability unit VIIs-9, woodland suitability group 4)

Burkhardt Series

The Burkhardt series consists of soils that are shallow and somewhat excessively drained. These soils have formed on stream terraces in medium-textured material over outwash sand and gravel. They are mainly on terraces of the Mississippi River. To a lesser extent, they occur along the St. Croix, Rush, and Trimbelle Rivers.

Representative profile of a cultivated Burkhardt sandy loam:

0 to 12 inches, very dark brown, very friable sandy loam.
12 to 16 inches, dark reddish-brown, friable loam.
16 to 18 inches, dark reddish-brown, very friable gravelly sandy loam.
18 to 30 inches, dark-brown, loose, stratified sandy gravel.

Burkhardt soils are rapidly permeable, have rapid internal drainage, and have low available moisture capacity. They are slightly acid to medium acid. Natural fertility is moderate, and these soils respond well to applications of fertilizer. Roots can penetrate to the gravelly substratum.

Although these soils are not especially extensive, they are important locally and are suited to soybeans, corn, and all the other crops grown in the area. They are only moderately productive, however, mainly because of their low available moisture capacity. Good management and good distribution of rainfall are necessary for even fair yields. In places wind erosion is a hazard on the broad, open terraces.

Burkhardt loam, 0 to 2 percent slopes (BrA).—This is a nearly level soil on high stream terraces. Except that it has a finer texture in the upper part of the solum, its profile is similar to the one described for the series. The surface layer is 10 to 15 inches thick.

The amount of water that runs off this soil is small. Therefore, water erosion is not a serious hazard. Wind erosion may be a hazard, however, on the broad, open plains. This soil has moderately rapid permeability and rapid internal drainage. Because of the finer textured material in the upper part of the soil profile, the available moisture capacity is normally higher than that of the Burkhardt sandy loams. Also, yields are generally higher on this soil than on the Burkhardt sandy loams, and better response is received from fertilizer. Management practices that conserve moisture are suggested. (Capability unit IIIs-2, woodland suitability group 12)

Burkhardt sandy loam, 0 to 2 percent slopes (BuA).—The profile of this soil is the one described for the series. Practically no water erosion has taken place, because little water runs off the surface of this nearly level soil. Wind erosion is a hazard, however, in the broad, open areas.

Water enters this soil easily and rapidly, but the soil material is too porous for much moisture to be retained in the root zone. Response to fertilizer is only moderate. Large applications of fertilizer are generally not considered to be worthwhile. (Capability unit IIIs-2, woodland suitability group 5)

Burkhardt sandy loam, 2 to 6 percent slopes (BuB).—The profile of this soil is less deep than the one described as typical for the series. Also, the surface layer is dark brown in spots, because material from the subsoil has been mixed into it by tillage. Normally, the surface layer is between 8 and 12 inches thick.

Included in mapped areas of this soil are small areas of Burkhardt loam, 2 to 6 percent slopes. Also included are areas of Burkhardt sandy loam, 2 to 6 percent slopes, moderately eroded.

Erosion by water and wind are slight hazards. If Burkhardt sandy loam, 2 to 6 percent slopes, is to be used year after year for cultivated crops, practices that control erosion are needed.

Most areas of this soil are used for cultivated crops, mainly corn, soybeans, small grains, and forage crops. Because this soil is droughty, yields are low. (Capability unit IIIe-4, woodland suitability group 5)

Chaseburg Series

The Chaseburg series consists of deep soils that are well drained or moderately well drained. These soils have formed in a layer of silty sediment, more than 42 inches thick, washed from light-colored, silty soils of uplands and terraces or deposited as the result of soil creep. They occur throughout the county. The areas are small and widely distributed. They are at the heads of draws, along intermittent streams that flow out of small drainage basins, and along the base of steep slopes. Generally, these soils have slopes no greater than 6 percent, but the slopes are steeper in a small acreage.

Representative profile of Chaseburg silt loam:

0 to 24 inches, very dark grayish-brown, very friable silt loam.
24 to 32 inches, dark grayish-brown, friable silt loam.
32 to 42 inches, dark-brown, friable silt loam.
42 inches +; yellowish-brown, friable silt loam.

The Chaseburg soils have moderate permeability and high available moisture capacity. The reaction is neutral to medium acid. These soils are friable and have a deep root zone. The content of organic matter is rather low, but natural fertility is high.

Chaseburg silt loam, 0 to 2 percent slopes (CaA).—This is a nearly level soil along intermittent drainageways. Its profile is like the one described for the series. This soil is subject to flooding. As a result, an overwash of sandy loam covers the surface in a few places.

This soil is suited to all the crops commonly grown in the county. It can be cropped intensively if a good supply of plant nutrients is maintained, and if a suitable cropping system is used. The crops respond well to good management. Erosion is a slight hazard. Except where flooding occurs, however, no special practices are required to protect this soil. In areas subject to flooding, dikes can be used to provide protection. Otherwise, the areas should be kept in pasture or trees.

Crops on this soil respond well if a commercial fertilizer is applied. In most places yields of corn are low because nitrogen is needed. In many places lime is required for high yields of legumes. (Capability unit I-1, woodland suitability group 1)

Chaseburg silt loam, 2 to 6 percent slopes (CaB).—This is a gently sloping soil in drainageways, on bottoms along intermittent streams, and on alluvial fans on terraces and high bottoms. Its surface layer is dark grayish brown and is slightly thinner than that of the profile described for the series. In places, especially at the heads of draws, a few stones are on the surface or throughout the profile. Included in areas mapped as this soil are a few acres of more sloping Chaseburg soils.

Chaseburg silt loam, 2 to 6 percent slopes, is slightly more susceptible to erosion than Chaseburg silt loam, 0 to 2 percent slopes. More careful management is needed to protect it, although the two soils are suited to the same crops. Practices are needed that prevent further damage caused by soil material washing onto this soil from higher lying areas. (Capability unit IIe–5, woodland suitability group 1)

Chetek Series

The Chetek series consists of well-drained soils that are shallow over sand and gravel. These soils are on glacial outwash plains and stream terraces. They occur mainly in the extreme northwestern corner of the county, along the Kinnickinnic River to River Falls. They have formed in less than 24 inches of moderately coarse textured to medium-textured outwash material over sand and gravel. The underlying sand and gravel are generally stratified and are of glacial origin. The larger tracts of these soils occur where the topography is complex. The smaller areas are on terraces along the major streams, and the soils in those areas are nearly level or gently sloping. Although these soils are not extensive, locally they are important for farming.

Representative profile of Chetek sandy loam:

0 to 9 inches, very dark grayish-brown, very friable sandy loam.
9 to 21 inches, dark-brown, friable sandy loam; lower half contains stones and cobbles.
21 to 42 inches +, dark-brown, loose fine gravel and sand.

The Chetek soils have rapid permeability and rapid internal drainage. They have low available moisture capacity and are moderately droughty during periods when rainfall is poorly distributed. If they are cultivated, these soils are susceptible to erosion by wind and water. They have moderately low natural fertility and are slightly acid to medium acid. In general, the root zone of plants extends to the bottom of the subsoil, but some of the larger roots enter the substratum. These soils contain no restricting layer.

Chetek sandy loam, 2 to 6 percent slopes (ChB).—This soil is on stream terraces and outwash plains. On the terraces, it generally occurs on single slopes. On the outwash plains, it occurs where the topography is complex and hummocky. This soil has the profile described as typical for the series. It has lost little of its surface layer through erosion, but there is a slight hazard of future erosion by wind and water.

Where this soil is adjacent to steeper soils, as on the dissected outwash plain in the northwestern corner of the county, it is used for permanent pasture. Most of the acreage, however, is used for field crops. If this soil is properly managed to protect it from erosion and to overcome the tendency to droughtiness, it can be used for all the locally grown crops. In the areas where the topography is complex, practices such as contour stripcropping are not feasible. (Capability unit IIIe–4, woodland suitability group 5)

Chetek sandy loam, 12 to 20 percent slopes, moderately eroded (ChD2).—This soil is mainly in areas of complex slopes on dissected outwash plains. Its surface layer is thinner than the one in the profile described as typical for the series, because part of it has been lost through erosion. Also, the profile is generally shallower over sand and gravel than the one described. In the steeper areas, sand and gravel are nearer the surface than in the less sloping ones.

The steeper slopes and erosion make this soil more droughty than Chetek sandy loam, 2 to 6 percent slopes. Contour stripcropping and other practices that conserve the soil are not feasible in these areas of complex topography. Limitations to growing cultivated crops are very severe, but this soil can be used for grass or planted to trees. The complex topography makes the operation of equipment difficult and hazardous. (Capability unit VIe–4, woodland suitability group 5)

Clyde Series

The Clyde series consists of poorly drained soils in shallow depressions and natural drainageways in the uplands. These soils occupy scattered areas in the northern half of the county. They have formed under a cover of reeds, sedges, and other plants that tolerate a large amount of water. The material in which the soils formed is 18 to 30 inches of windblown silt (loess) over glacial till. The dark color of their surface layer is the result of organic matter having accumulated in very wet areas.

Representative profile of Clyde silt loam:

0 to 15 inches, black, friable silt loam.
15 to 19 inches, olive-gray silt loam; medium, strong-brown mottles and dark-gray stains; wet but not sticky.
19 to 26 inches, gray silt loam; many, coarse, reddish-brown mottles; wet but not sticky.
26 to 29 inches, gray loam; many, coarse, dark-brown and reddish-brown mottles; wet but not sticky.
29 inches +, grayish-brown sandy loam; wet but not sticky.

The Clyde soils receive deposits of silty material from adjacent areas. They also receive water that flows from the adjacent slopes, as well as water that falls as precipitation. Surface runoff is so slow that water covers the surface for significant periods. Much of this water passes through the profile, although internal drainage is slow. Permeability is moderately slow, and the available moisture capacity is high. These soils have neutral to mildly alkaline reaction. The root zone for most crops extends only to a depth of about 15 inches. Lack of air discourages deeper penetration of roots, but a few large roots penetrate to a greater depth. The surface layer is thick and dark colored, and it has a high content of organic matter. Unless they are drained, these soils have little importance for farming because of their limited potential for producing good yields.

Clyde silt loam (Cl).—This is the only Clyde soil mapped in this county. It is in shallow depressions and in natural drainageways. Wetness is caused by the combined effects of the slow permeability of the till substratum, by

runoff and seepage from adjoining areas, and, in some places, by poor surface drainage. Most of these wet areas are used for pasture. In most places the texture of the surface layer is silt loam. In some places where this soil occurs near the center of broad drainageways, however, more clay has accumulated than in other areas and the texture of the surface layer is silty clay loam. Also, in some areas a few inches of silty material have been deposited on the surface.

Wetness is the main limitation of this soil, but erosion is a slight hazard if cultivated crops are grown. Many of the areas in natural drainageways are subject to flooding for short periods of time. Protection from erosion, as well as drainage, is necessary if cultivated crops are to be grown. Where this soil has not been drained, it should be kept in meadow or pasture, or it can be used to provide habitats for wildlife. (Capability unit IIw–1, woodland suitability group 12)

Dakota Series

The Dakota series consists of moderately deep, well-drained soils that are nearly level or gently sloping. These soils are on outwash plains and on terraces of the major streams in the western half of the county. The Dakota soils that have a loamy substratum are in the valleys of the Kinnickinnic, Trimbelle, and Big Rivers. They formed in medium-textured material over outwash sand.

Representative profile of an uneroded cultivated Dakota loam:

0 to 11 inches, very dark gray, friable loam.
11 to 26 inches, dark-brown, friable loam over dark yellowish-brown heavy loam.
26 to 32 inches, dark-brown, friable sandy loam.
32 inches +, yellowish-brown, loose, layered sand.

Permeability of the Dakota soils is moderate or moderately rapid, and the available moisture capacity is moderate to low. Internal drainage is rapid. These soils have moderate natural fertility. Crops grown on them respond well to applications of fertilizer. The surface layer has a neutral reaction in areas where lime has been added. Below a depth of 7 inches, however, these soils are slightly acid to medium acid. Roots can penetrate to the sandy substratum. The Dakota sandy loams are moderately droughty. Good management and good distribution of rainfall throughout the growing season are necessary for optimum yields on all of the Dakota soils.

These soils are productive and are desirable for crops. They are fairly extensive and are significant to the agriculture of the county.

Dakota loam, 0 to 2 percent slopes (DaA).—This is a nearly level soil on broad stream terraces. Its profile is similar to the one described for the series. The texture is loam throughout the profile, however, and the dark-colored surface layer is as much as 4 inches thicker in some places. Erosion is not a hazard, but this soil is slightly droughty.

This soil can be cultivated intensively if favorable soil structure and good permeability are maintained. Practices that conserve moisture are needed to improve yields. Row crops can be grown year after year if all the crop residue is returned to the soil, if a good supply of plant nutrients and good tilth are maintained, and if minimum tillage is practiced. A suitable cropping system is 1 year each of a row crop, a small grain, and meadow. (Capability unit IIs–1, woodland suitability group 12)

Dakota loam, 2 to 6 percent slopes (DaB).—This is a gently sloping soil on stream terraces. Except that its texture is loam to a depth of about 30 inches, the profile is like the one described for the series. Included in mapped areas of this soil are small areas of Dakota loam, 2 to 6 percent slopes, moderately eroded.

Erosion is a slight hazard, and Dakota loam, 2 to 6 percent slopes, is slightly droughty. If it is properly managed, however, it is suited to all the crops commonly grown in the area. The crops may be damaged by lack of moisture during dry years, or when rainfall is poorly distributed during the growing season.

Except for the hazard of erosion, the limitations of this soil are similar to those of Dakota loam, 0 to 2 percent slopes. Management is also similar. (Capability unit IIe–2, woodland suitability group 12)

Dakota loam, 6 to 12 percent slopes, moderately eroded (DaC2).—This is a moderately steep or steep soil on the edges of terraces and in deeply incised drainageways that dissect the terraces. Most of the acreage has been cultivated. In the cultivated areas, erosion has removed from one-third to two-thirds of the original surface layer. The present surface layer is thinner than the one in the profile described for the series. Also, unlike the profile described for the series, the profile of this soil has a loam texture throughout.

This soil is not well suited to row crops unless practices are used to protect it from erosion and to conserve moisture. It is subject to severe erosion and is slightly droughty. Because of its position on the edges of terraces and in draws, it must be protected from gully erosion. Contour stripcropping is the preferred practice, for it not only protects the soil from erosion but it also conserves moisture. (Capability unit IIIe–2, woodland suitability group 12)

Dakota loam, loamy substratum, 0 to 2 percent slopes (DbA).—This soil has a profile similar to the one described for the series. The texture is loam throughout the profile, however, and a layer of material that ranges from loam to sandy clay loam in texture is at a depth of about 30 inches. Permeability is slower and the available moisture capacity is higher in this soil than in Dakota soils that lack the layer of loamy material. A small acreage of a Dakota sandy loam that has a loamy substratum is included in mapped areas of this soil.

Dakota loam, loamy substratum, 0 to 2 percent slopes, is less droughty than Dakota loam, 0 to 2 percent slopes. Other limitations are similar, however, and management is somewhat similar. (Capability unit I–1, woodland suitability group 12)

Dakota loam, loamy substratum, 2 to 6 percent slopes (DbB).—This is a gently sloping soil on stream terraces. Its profile is similar to the one described for the series, except that it is underlain by a layer of loamy material and is less deep over outwash sand.

Included in mapped areas of this soil are small areas of Dakota loam, loamy substratum, 2 to 6 percent slopes, moderately eroded. Also included is a rather small acreage of a Dakota sandy loam that has a loamy substratum.

Permeability is slower and the available moisture ca-

pacity is higher in Dakota loam, loamy substratum, 2 to 6 percent slopes, than in the Dakota soils that lack a loamy substratum. Limitations are less severe and management is simpler than for Dakota loam, 2 to 6 percent slopes. (Capability unit IIe–1, woodland suitability group 12)

Dakota loam, rock substratum, 0 to 2 percent slopes (DcA).—This is a nearly level soil on limestone terraces. Its profile is similar to the one described for the series. Fissured dolomite is at a depth of 36 to 42 inches, however, and loose, sandy outwash overlies the limerock in most areas of this soil. In some places a layer of sandy loam or loam, a few inches thick, overlies the limerock. In those areas the available moisture capacity is higher than in places where this soil is underlain by sandy outwash.

If suitable practices are applied to conserve moisture, this soil is suited to all the crops grown in the county. High yields can be obtained if good management is practiced and if rainfall is well distributed throughout the growing season. Applications of barnyard manure and of commercial fertilizer are essential for optimum yields. (Capability unit IIs–1, woodland suitability group 12)

Dakota loam, rock substratum, 2 to 6 percent slopes, eroded (DcB2).—This soil has lost from one-third to two-thirds of its original surface layer through erosion. Its present surface layer is slightly thinner than the one in the profile described for the series, and the profile has a loam texture throughout. Also, fissured dolomite is at a depth between 36 and 40 inches. In some spots part of the subsoil is mixed with the surface soil. In those places the present surface layer is lower in content of organic matter and is in poorer tilth than the surface layer in less eroded Dakota soils underlain by bedrock. Also, tillage is more difficult, the rate of infiltration is slower, and the amount of runoff is greater.

Practices that control erosion are needed to prevent the surface layer of this gently sloping soil from becoming thinner and to prevent further reduction of the available moisture capacity. Also suggested are practices that conserve moisture. The rate of infiltration can be increased and tilth can be improved by plowing under crop residue and applying manure. Otherwise, the management of this soil and the limitations are similar to those of Dakota loam, rock substratum, 0 to 2 percent slopes. Also similar are the crops grown on these two soils. (Capability unit IIe–2, woodland suitability group 12)

Dakota sandy loam, 0 to 2 percent slopes (DdA).—This soil is on stream terraces and outwash plains. Its profile is like the one described for the series. Because this soil is nearly level, the amount of runoff is small. No noticeable erosion has taken place, although wind erosion is a hazard.

This soil is suited to all the crops commonly grown in the county. Except in years when the amount of rainfall is low, or rainfall is poorly distributed throughout the growing season, the soil is moderately productive if it is well managed. The capacity for storing moisture is low. In dry years corn, hay, and other crops planted late in the season are generally damaged by drought. Practices are needed to control wind erosion. (Capability unit IIIs–2, woodland suitability group 3)

Dakota sandy loam, 2 to 6 percent slopes (DdB).—This soil is on stream terraces. Its profile is similar to the one described for the series, but it is less deep over sand and gravel in some places. This soil is slightly susceptible to erosion because of the gentle slopes. Included with it in mapping are small areas of Dakota sandy loam, 2 to 6 percent slopes, moderately eroded.

The crops grown are similar to those grown on Dakota sandy loam, 0 to 2 percent slopes, and the limitations and management are somewhat similar. Careful management is required, however, to protect this soil from erosion. (Capability unit IIIe–4, woodland suitability group 3)

Derinda Series

The Derinda series consists of moderately well drained or well drained, silty soils of uplands underlain by shale bedrock. These soils are mainly gently sloping to steep. They are in the north-central part of the county, where they commonly occupy fringe areas on the tops of broad ridges.

Representative profile of Derinda silt loam:

0 to 7 inches, very dark gray, friable silt loam.
7 to 14 inches, brown, friable silt loam.
14 to 20 inches, dark-brown, firm silty clay loam.
20 to 25 inches, dark-brown silty clay loam; few, fine, yellowish-brown mottles; plastic when wet.
25 to 40 inches, light olive-brown silty clay; many, fine, grayish-brown and yellowish-brown mottles; plastic when wet.

The permeability of the Derinda soils is moderately slow; it is restricted by the very slow permeability of the shale substratum. Internal drainage is somewhat slow, and the available moisture capacity is low. In general, the root zone extends to the upper limits of the layer of weathered shale, but some larger roots penetrate into the shale. These soils are medium acid to strongly acid, but the underlying shale is slightly acid to mildly alkaline.

Derinda silt loam, 0 to 2 percent slopes (DeA).—This soil is most extensive on the broad ridgetops north of Beldenville. Although it is cultivated, no noticeable erosion has taken place. The surface layer is slightly thicker than the one in the profile described for the series. Surface runoff is very slow.

No erosion control practices are necessary, but this soil is droughty and practices that conserve moisture are needed. Row crops can be grown 2 years out of 4 if an adequate supply of plant nutrients is maintained, and if crop residue is returned to the soil. (Capability unit IIIs–8, woodland suitability group 1)

Derinda silt loam, 2 to 6 percent slopes (DeB).—This is a gently sloping soil on ridgetops in the uplands. In most places it is wooded and is on narrow ridgetops, on the ends of ridges, in other inaccessible areas, or in areas otherwise poorly suited to cultivation. In the wooded tracts, leaf litter protects this soil from erosion. The surface layer in the wooded areas is thicker than the one in the profile described for the series. In the areas that are cultivated, the slopes are generally less than 4 percent. In those places no noticeable erosion has taken place.

The potential for good yields is high in cultivated areas of this soil if lime and fertilizer are applied. The amount of lime and the kinds and amounts of fertilizer should be determined by testing the soils. Erosion is a slight hazard, and this soil is somewhat droughty. Practices that control erosion and that conserve moisture are needed if row crops are grown. In the wooded areas, pro-

tection is needed from fire and grazing. (Capability unit IIIe-3, woodland suitability group 1)

Derinda silt loam, 2 to 6 percent slopes, moderately eroded (DeB2).—This soil is on the rounded tops of ridges. It has lost from one-third to two-thirds of its original surface layer through erosion. In many places the present surface layer is lighter colored than the original one. This is because tillage has mixed soil material from the subsoil with the remaining material in the surface layer. The profile of this soil is like the one described for the series.

If this soil is properly managed, it is fairly productive and is suited to row crops, small grains, and hay. Nearly all of the areas are cultivated. Runoff is not excessive, but some practices are needed that control erosion and conserve moisture. Such practices prevent losses of additional surface soil and overcome the tendency toward droughtiness. Crops grown on this soil respond well to applications of lime and fertilizer. (Capability unit IIIe-3, woodland suitability group 1)

Derinda silt loam, 6 to 12 percent slopes (DeC).—Because it occurs on ridges in the uplands, this sloping soil is not well suited to tillage. Most of the areas are wooded or in pasture, and little or no erosion has taken place. The surface layer is thinner than the one in the profile described for the series, and shale bedrock is nearer the surface.

This soil is droughty and is moderately susceptible to erosion if it is cultivated. Careful management is required to control erosion. Row crops should be grown only where practices that protect the soil are applied and where the slopes are short. The areas in trees ought to be managed for sustained production of timber. (Capability unit IVe-3, woodland suitability group 1)

Derinda silt loam, 6 to 12 percent slopes, moderately eroded (DeC2).—This soil is on the side slopes of ridges. In most of the acreage, mixing by tillage has made the present surface layer lighter colored than the original one and the present surface layer is dark grayish brown. The present surface layer is lighter colored than the one in the profile described for the series. In some places as much as two-thirds of the original surface layer has been lost through erosion and the present surface layer is 4 to 8 inches thick.

Such crops as oats and alfalfa-brome hay are the main crops grown on this soil. Yields are generally fairly high if practices are used to control erosion, if practices that conserve moisture are used, and if adequate amounts of lime and fertilizer are applied. (Capability unit IVe-3, woodland suitability group 1)

Derinda silt loam, 12 to 20 percent slopes (DeD).—This soil is along the upper edges of valleys and coulees that have remained in trees. It is adjacent to wooded areas of Steep stony and rocky land. This soil is ideally suited to trees and to use as wildlife habitats, and most of the acreage is in trees. The surface layer contains more organic matter and is generally darker colored than the one in the profile described for the series.

This soil can be used for forage crops. The severe hazard of erosion and the moderately steep slopes make it unsuitable for row crops. (Capability unit VIe-3, woodland suitability group 1)

Derinda silt loam, 12 to 20 percent slopes, moderately eroded (DeD2).—This soil is in areas similar to those occupied by Derinda silt loam, 12 to 20 percent slopes. Unlike that soil, however, it has been cultivated along with less sloping soils. In most places it has lost from one-third to two-thirds or more of the original surface layer through erosion. The present surface layer is lighter colored and is in poorer tilth than the original one, and the subsoil is exposed in some spots. The surface layer is low in content of organic matter and has a slow rate of infiltration. Generally, the profile is thinner than that of less sloping and less eroded Derinda soils. The hazard of water erosion is severe, and drought is a hazard during extended dry periods.

This soil is not well suited to cultivated crops. It can be used, however, to grow forage crops for hay or pasture. Also, it can be used as woodland or to provide food and cover for wildlife. If this soil is pastured, grazing should be controlled. Then, a firm sod can be maintained and gullying will be avoided. (Capability unit VIe-3, woodland suitability group 1)

Derinda silt loam, 20 to 30 percent slopes (DeE).—This soil is on the steep side slopes of ridges in the uplands. The layers in its profile are slightly thinner than those in the profile described for the series, and shale bedrock is slightly nearer the surface.

Included in mapped areas of this soil are small areas of shallower Derinda soils. These included soils are underlain by shale bedrock at a depth of less than 12 inches, and shale is exposed at the surface in a few places.

Derinda silt loam, 20 to 30 percent slopes, is suited to pasture, to trees, and to use as wildlife areas. In areas that are pastured, grazing should be controlled so that a good cover of sod will be maintained. (Capability unit VIIe-3, woodland suitability group 1)

Derinda Series, Acid Variants

In some soil series, a variant is included. A variant has many of the characteristics of the series in which it is placed, but it differs in at least one important characteristic, which is indicated by its name. The acreage of a variant is of too small extent to justify establishing a new series. A new series may be designated and replace the variant, however, if sufficient acreage is later found.

Acid variants of the Derinda series in this county are represented by well drained or moderately well drained silt loams that are sloping to steep. Unlike the soils of the Derinda series, they are underlain by extremely acid shale. These variants are on uplands and valley slopes. They occur in a valley that occupies about 9 square miles in the watershed of Plum Creek. This valley is in the southwestern corner of Rock Elm Township and was formed by the confluence of two streams.

Representative profile of Derinda silt loam, acid variant:

0 to 9 inches, dark grayish-brown, friable silt loam.
9 to 11 inches, brown, friable silt loam.
11 to 17 inches, dark-brown, very firm silty clay loam; very few, fine, yellowish-brown mottles.
17 to 27 inches, olive-gray, very firm silty clay; few, fine, yellowish-red and yellowish-brown mottles.
27 to 32 inches +, olive-gray, very firm, loosely bedded shale; many yellowish-brown, horizontal streaks.

The permeability of the acid variants of the Derinda series is moderately slow. It is restricted by the very

slowly permeable underlying shale. Internal drainage is somewhat slow, and the available moisture capacity is low. The characteristics of these soils favor penetration of roots to the substratum of extremely acid, weathered shale. The surface layer is slightly acid, and the lower part of the subsoil is extremely acid. Where the shale is near the surface, the soil reaction is so acid that the growth of some otherwise locally adapted crops is restricted.

Where a large amount of lime is applied in the shallow or eroded areas, fair crop yields can be obtained. Yields are moderately good, however, in areas where the mantle of silty material is deeper and the reaction is less acid. These soils are not significant to the agriculture of the county, but locally, they are important.

Derinda silt loam, acid variant, 6 to 12 percent slopes, moderately eroded (DfC2).—The profile of this sloping soil is like the one described as typical for the acid variants of the Derinda series. A significant part of the original surface layer has been lost through erosion. As a result, tilth has deteriorated and the rate of infiltration has become slower. Also, drought is an increasing hazard and the very strongly acid shale is nearer the surface than it formerly was. Small areas of Derinda silt loam, acid variant, 6 to 12 percent slopes, are included in mapped areas of this soil.

Further erosion is a moderate hazard, and this moderately eroded soil is not well suited to row crops. Where cultivated crops are grown, intensive practices are needed that control erosion and conserve moisture. If contour stripcropping is practiced, row crops should be grown only on the short slopes. (Capability unit IVe–3) woodland suitability group 5)

Derinda silt loam, acid variant, 12 to 20 percent slopes, eroded (DfD2).—The profile of this soil is generally thinner than the one described as typical for acid variants of the Derinda series. A significant part of the original surface layer has been lost through erosion. The present surface layer is generally dark grayish brown and is about 5 to 7 inches thick. Small areas of Derinda silt loam, acid variant, 12 to 20 percent slopes, and of Derinda silt loam, acid variant, 20 to 30 percent slopes, are included in mapped areas of this soil.

In areas of Derinda silt loam, acid variant, 12 to 20 percent slopes, eroded, that are used for pasture, control of grazing is necessary so that a firm sod is maintained. Cattle should not be allowed to make trails where runoff can concentrate and cause gullying. Topdressing with fertilizer also helps to maintain a firm sod and greatly increases the yields of forage. (Capability unit VIe–3, woodland suitability group 5)

Dickinson Series

The Dickinson series is composed of deep soils that are well drained. These soils are gently sloping. They occupy outwash plains northeast of Prescott, where they formed in windblown very fine sand. Where the wind has blown the soil material into mounds that resemble dunes, these soils have a surface layer of fine sandy loam. The profile contains weakly defined, layered material.

Representative profile of Dickinson fine sandy loam:

0 to 15 inches, very dark grayish-brown, very friable fine sandy loam.
15 to 29 inches, dark-brown, very friable very fine sandy loam.
29 to 34 inches, dark-brown, firm loam.
34 to 44 inches, dark-brown, very friable very fine sandy loam.
44 to 60 inches +, brown, very friable very fine sandy loam.

Dickinson soils have moderately rapid permeability and fair available moisture capacity. They are medium acid to slightly acid. Natural fertility is moderate.

Dickinson fine sandy loam, 2 to 6 percent slopes, moderately eroded (DkB2).—This is the only Dickinson soil mapped in Pierce County. Its profile is the one described for the series.

Included in the mapped areas of this soil is a small acreage of a comparatively uneroded soil. Also included is a small area, about 12 acres in extent, of Dickinson very fine sandy loam, 6 to 12 percent slopes, moderately eroded.

Further erosion by wind and water is a slight hazard, and Dickinson fine sandy loam, 2 to 6 percent slopes, moderately eroded, is also slightly droughty. If this soil is properly managed, however, it is suited to all of the locally grown crops, and practically all of the acreage is cultivated. The included Dickinson soil is more susceptible to erosion than this soil, and it requires more careful management. In some places erosion can be controlled by using a suitable cropping system. Such practices as contour stripcropping are needed in other places to conserve water and to help to control erosion by wind and water. (Capability unit IIe–7, woodland suitability group 3)

Downs Series

The Downs series consists of deep, well-drained, silty soils that are gently sloping or sloping. These soils are on upland ridges, mainly in the south-central part of the county. They have formed in a mantle of silty windblown material that is more than 42 inches thick.

Representative profile of a cultivated Downs silt loam:

0 to 9 inches, very dark grayish-brown, friable silt loam.
9 to 11 inches, dark grayish-brown, friable silt loam.
11 to 42 inches, dark-brown, firm silt loam.
42 to 66 inches +, dark-brown, friable silt loam.

The Downs soils have moderate permeability to a depth of about 40 inches and moderately slow permeability below that depth. They have high available moisture capacity and are medium to strongly acid. These soils are highly desirable for crops and are important to the agriculture of the county. They are well suited to all of the locally grown crops.

Downs silt loam, 2 to 6 percent slopes (DoB).—In most places this soil has a profile like the one described for the series. In a few small areas that are not cultivated, however, the surface layer is black or very dark brown. This soil is gently sloping and is on the rounded central parts of broad ridges. Runoff is not excessive, and erosion has been slight.

This soil is well suited to row crops, small grains, and hay. Practices that control erosion are needed, however, to help to protect the fertile surface soil. (Capability unit IIe–1, woodland suitability group 1)

Downs silt loam, 2 to 6 percent slopes, moderately eroded (DoB2).—This soil is on broad ridgetops and occurs near the central part of the ridges. Its surface layer is slightly thinner than the one in the profile described as

typical for the series, because part of it has been lost as the result of water erosion. It is only 6 to 8 inches thick.

This soil is highly productive if it is properly managed. It is well suited to row crops, small grains, and hay. Further erosion is a hazard, however, if cultivated crops are grown, and if practices are not used to control erosion. Terraces, contour stripcropping, and proper management of crop residue help to reduce runoff and to control erosion. Crops grown on this soil respond well if lime and fertilizer are applied. (Capability unit IIe-1, woodland suitability group 1)

Downs silt loam, 6 to 12 percent slopes, moderately eroded (DoC2).—In some places this soil occupies an entire ridgetop. In others it occurs only along the outer edges of the ridgetop, just below areas of less sloping Downs soils. From one-third to two-thirds of the original surface layer has been lost through erosion, and about 4 to 8 inches of the original surface layer remains.

If this soil is properly managed, it is well suited to row crops, small grains, and hay. Nearly all of the acreage is used for crops. Practices that control erosion are needed. Tilth is improved, the ability of this soil to absorb rainfall is made greater, and runoff is reduced if organic matter is returned. This can be done by using a cropping system that provides a large proportion of close-growing crops. This soil is highly productive if it is well managed, and if enough plant nutrients and lime are applied. (Capability unit IIIe-1, woodland suitability group 1)

Dubuque Series

The Dubuque series consists of moderately deep, well-drained soils that are silty. These soils are gently sloping to steep and are mainly on ridges in the uplands. Nearly level to sloping Dubuque soils, however, also occur in the northwestern part of the county in an area where the Kinnickinnic River has cut a gorge into a rock-formed bench. The Dubuque soils have formed in a mantle of loess over clayey material that has weathered from dolomite. They are underlain by fissured dolomite.

Representative profile of a cultivated Dubuque silt loam:

0 to 9 inches, very dark grayish-brown, friable silt loam.
9 to 13 inches, brown, friable silt loam.
13 to 34 inches, dark yellowish-brown, firm silty clay loam.
34 to 40 inches, reddish-brown, firm clay loam.
40 to 56 inches, dark reddish-brown, sticky clay.
56 inches +, fissured dolomite.

In the Dubuque soils, permeability is moderately slow above the layer of clay and slow in the clay. These soils have moderate to high available moisture capacity. The silty upper part of their profile is medium acid to strongly acid, but the layer of clay is mildly alkaline. The underlying bedrock restricts the root zone. Natural fertility is moderately high, but crops grown on these soils respond well to applications of fertilizer and lime. In Pierce County these soils have potential for high yields and are used mainly for crops.

Dubuque silt loam, 0 to 2 percent slopes (DsA).—This soil is mainly on limestone terraces along the Kinnickinnic River. Its profile is like the one described for the series, except that limestone bedrock is generally at a depth between 30 and 42 inches. Also, the layer of clay is thinner, or only several inches thick. This soil is nearly level, and runoff is very slow. Although most of the acreage is cultivated, there has been no noticeable erosion.

This soil can be cropped intensively if a good supply of plant nutrients is maintained, and if all the crop residue is returned. Practices that control erosion are not needed. (Capability unit I-1, woodland suitability group 1)

Dubuque silt loam, 2 to 6 percent slopes (DsB).—This is a gently sloping soil on upland ridgetops and limestone terraces. In most places it is on narrow ridgetops, on the ends of ridges, or in other places that are inaccessible or that are not well suited to cultivation. This soil is mainly in trees and is protected from erosion by a layer of leaf litter. Where the areas are cultivated, the slopes are generally less than 4 percent and erosion has not been a serious hazard. In cultivated areas the profile of this soil is similar to the one described for the series. In wooded areas the surface layer is thinner and is generally darker colored than the one described.

Crops grown on this soil have potential for high yields if fertilizer and lime are applied. Erosion is a slight hazard, but a fairly intensive cropping system can safely be used if simple practices are applied to control erosion. The wooded areas need protection from fire and grazing. (Capability unit IIe-1, woodland suitability group 1)

Dubuque silt loam, 2 to 6 percent slopes, moderately eroded (DsB2).—This soil is on the rounded tops of ridges and on rock-formed terraces. The surface soil has been mixed by tillage and is dark grayish brown or very dark grayish brown. From one-third to two-thirds of the original surface layer has been lost through erosion, and the present surface layer is only 4 to 8 inches thick.

If this gently sloping soil is properly managed, it is highly productive and is well suited to row crops, small grains, and hay. Nearly all of the acreage is cultivated. Runoff is not excessive, but some practices are needed to control erosion. Crops grown on this soil respond well to applications of lime and fertilizer. (Capability unit IIe-1, woodland suitability group 1)

Dubuque silt loam, 6 to 12 percent slopes (DsC).—This is a sloping soil in areas on upland ridges and limestone terraces that are not well suited to tillage. Most of the acreage is wooded or in pasture, and little or no erosion has taken place. The profile of this soil is the one described for the series.

This soil is moderately susceptible to erosion. If cultivated crops are grown, careful management is required to protect it. Contour stripcropping should be practiced on the long slopes if row crops are included in the cropping system. (Capability unit IIIe-1, woodland suitability group 1)

Dubuque silt loam, 6 to 12 percent slopes, moderately eroded (DsC2).—This soil is on the side slopes of ridges. Tillage has mixed material from the subsoil with its surface soil. The present surface layer is dark grayish brown, or lighter colored than the one in the profile described for the series. As much as two-thirds of the original surface layer has been lost through erosion, and the present surface layer is 4 to 8 inches thick.

Nearly all of the acreage of this soil is cultivated. Corn, oats, and alfalfa-brome are the main crops. High yields of these crops can be obtained if practices are used to control erosion, and if adequate amounts of lime and

fertilizer are applied. (Capability unit IIIe-1, woodland suitability group 1)

Dubuque silt loam, 12 to 20 percent slopes (DsD).—Except that the soil layers are slightly thinner and the dark reddish-brown clay is nearer the surface, the profile of this soil is similar to the profile described for the series. Depth to the layer of clay ranges from 24 to 28 inches. Much of the acreage is in trees, and in these wooded areas little or no erosion has taken place.

If this soil is used for crops, careful management is required because of the moderately steep slopes and the susceptibility to severe damage from erosion. Gullying is a hazard if runoff is allowed to concentrate. Row crops can be grown only where the slopes are not more than 200 feet long and where contour stripcropping is practiced.

A cropping system that does not include row crops is more suitable for this soil than one in which the crops require cultivation. Erosion can be controlled by carefully controlling grazing in the pastures and by managing the woodland for sustained production of timber. (Capability unit IVe-1, woodland suitability group 1)

Dubuque silt loam, 12 to 20 percent slopes, moderately eroded (DsD2).—This moderately steep soil has lost from one-third to two-thirds of its original surface layer through erosion. The present surface layer is 4 to 6 inches thick and is dark grayish brown. The profile is thinner over the layer of dark reddish-brown clay than the profile described for the series. The layer of clay is at a depth of about 24 to 28 inches.

This soil is not suited to intensive cultivation. Moderately high yields of small grains and hay are obtained, however, if practices are used to prevent damage from erosion, and if this soil is otherwise well managed. Using a cropping system that consists mainly of hay crops helps to control erosion. Also, lime and fertilizer should be applied according to the needs indicated by soil tests and the requirements of the crop to be grown. (Capability unit IVe-1, woodland suitability group 1)

Dubuque silt loam, 20 to 30 percent slopes (DsE).—This is a steep soil on the side slopes of ridges in the uplands. All of the acreage is wooded or in pasture. The layers in the profile are thinner than those in the profile described for the series. Also, the layer of clay weathered from dolomite is thinner, and bedrock is nearer the surface. In a few places, limestone bedrock crops out at the surface. Included in mapped areas of this soil are small areas of shallower Dubuque soils.

The hazard of erosion is very severe. Forage crops can be grown, however, and this soil can be used for pasture, trees, or wildlife areas. If this soil is pastured, grazing should be controlled so that a good cover of sod will be maintained. (Capability unit VIe-1, woodland suitability group 1)

Dubuque silt loam, 20 to 30 percent slopes, moderately eroded (DsE2).—In most places this soil has lost from one-third to two-thirds of its original surface layer through erosion. The present surface layer is lighter colored than the original one. In some spots where this soil is still cultivated, or where it is heavily grazed, the brown subsoil is exposed. The profile is thinner than the one described for the series. Also, it is underlain by a thinner layer of clay weathered from dolomite, and bedrock is nearer the surface. In a few places, limestone bedrock crops out. Included in mapped areas of this soil are a few acres of severely eroded Dubuque silt loam, 20 to 30 percent slopes.

Practices that control erosion are important on Dubuque silt loam, 20 to 30 percent slopes, moderately eroded, to reduce further losses from erosion. The crops grown on this soil are the same as those grown on Dubuque silt loam, 20 to 30 percent slopes, and the limitations and management are similar. (Capability unit VIe-1, woodland suitability group 1)

Dubuque silt loam, 30 to 40 percent slopes (DsF).—The surface layer of this soil is slightly thinner than the one in the profile described for the series. Runoff is rapid, and the hazard of erosion is very severe. This soil is suitable for trees, pasture, and wildlife areas. It is used mainly as woodland or for pasture. (Capability unit VIIe-1, woodland suitability group 1)

Dubuque soils, 2 to 6 percent slopes, severely eroded (DtB3).—The surface layer of these soils is thinner and lighter colored than the one in the profile described for the series. The texture of the surface layer is silty clay loam in some places and silt loam in others. More than two-thirds of the original surface layer has been lost through erosion, and the subsoil is exposed in much of the acreage. Some fragments of chert are on the surface.

Because of the poor tilth of the remaining soil material, these soils are difficult to farm. Most of the organic matter has been lost from the surface layer. The rate of infiltration is slower and the natural fertility is lower than in the uneroded Dubuque soils.

If these soils are cultivated, careful management is necessary because of the severe erosion. Liberal amounts of lime and fertilizer are required for good yields of crops. Also, management practices that supply organic matter must be used. (Capability unit IIIe-1, woodland suitability group 1)

Dubuque soils, 6 to 12 percent slopes, severely eroded (DtC3).—These sloping soils have lost more than two-thirds of their original surface layer through erosion. Tillage has mixed brown or reddish-brown, clayey soil material from the subsoil with the remaining surface soil. As a result, the present surface layer in many areas is finer textured than the surface layer in the profile described for the series. Its texture is silty clay loam or silt loam. Fragments of chert are commonly scattered over the surface.

Because of the poor tilth of the remaining soil material, these soils are difficult to farm and the areas are used mainly for hay or pasture. If field crops are grown, the present erosion and the severe hazard of further erosion make careful management necessary. For good yields, liberal amounts of lime and fertilizer are needed, as well as management practices that supply organic matter. (Capability unit IVe-1, woodland suitability group 1)

Dubuque soils, 12 to 20 percent slopes, severely eroded (DtD3).—The surface layer of these moderately steep soils is thinner than the surface layer in the profile described for the series. Also, the profile is thinner (about 24 inches thick) over reddish-brown clay. More than two-thirds of the original surface layer has been lost through

erosion, and the brown subsoil is exposed in much of the acreage. The texture of the present surface layer is silty clay loam or silt loam.

These soils have a slower rate of infiltration, are lower in content of organic matter, and are more difficult to keep in good tilth than the uneroded or moderately eroded Dubuque soils. The spots where the subsoil is exposed are more easily eroded than the areas where the surface layer is not eroded.

In the past these soils were used mainly for crops. Because of the severe erosion, however, many areas are now used for hay or pasture. Most of the time these soils should be kept in renovated pasture or in other sod-forming crops. (Capability unit VIe-1, woodland suitability group 1)

Dunbarton Series

The Dunbarton series consists of well-drained, silty soils that are shallow over dolomite. These soils have formed in a mantle of loess over clay loam weathered from dolomite. They are on uplands capped by dolomite and on rock-formed terraces. Fragments of chert are common on the surface and throughout the profile.

Representative profile of Dunbarton silt loam that has not been cultivated:

0 to 2 inches, very dark grayish-brown, very friable silt loam.
2 to 6 inches, grayish-brown, very friable silt loam.
6 to 12 inches, brown, friable silt loam.
12 to 20 inches, dark-brown, very firm clay loam.
20 inches +, light-gray, thinly layered dolomite.

Dunbarton soils have moderate permeability in the upper part of the soil profile, but they have slow permeability in the layer of clay loam. The available moisture capacity is moderately low. The upper part of the soil profile is medium acid to strongly acid. The clayey material weathered from dolomite, however, has neutral or mildly alkaline reaction. Natural fertility is moderately high, but yields are limited by the low available moisture capacity. These soils are somewhat droughty, and their root zone is limited by the underlying bedrock.

These soils have potential for moderate yields. During extended dry periods, however, crops are likely to be damaged by drought.

Dunbarton silt loam, 2 to 6 percent slopes (DuB).—This is a gently sloping or very gently sloping soil on uplands and on dolomite terraces along the St. Croix and Eau Galle Rivers. Few areas of these soils have been cultivated. In the areas that are cultivated, the slopes are very gentle and erosion is not a problem. In areas that have not been cultivated, the profile of this soil is like the profile described for the series. In the cultivated areas, the surface layer is thicker than the one in the profile described for the series.

This soil is slightly susceptible to erosion by water, and it is also slightly droughty. The yields of such crops as corn, oats, and alfalfa-brome hay are generally high if management is good. Fairly simple practices are needed to conserve water and to protect this soil from erosion. (Capability unit IIIe-3, woodland suitability group 5)

Dunbarton silt loam, 2 to 6 percent slopes, moderately eroded (DuB2).—This soil has lost from one-third to two-thirds of its original surface layer through erosion. The present surface layer is thicker, however, and is lighter colored than the one in the profile described for the series. Also, the profile is normally shallower over the layer of clay loam. Depth to dolomite bedrock is 20 inches or less.

Practices that control erosion are needed to protect this soil. A cropping system that supplies organic matter will improve tilth and increase the capacity to absorb rainfall. Crops grown on this soil respond well to applications of fertilizer and lime. (Capability unit IIIe-3, woodland suitability group 5)

Dunbarton silt loam, 6 to 12 percent slopes (DuC).—This soil is mainly on ridgetops that are too narrow or that have too odd a shape for cultivation. Some areas are inaccessible to farm equipment. Therefore, nearly all of the areas are wooded. The surface layer of this soil is darker colored than the one in the profile described for the series. In the wooded areas, the surface layer has been covered with leaf litter, and runoff and erosion have been very slight. Organic matter incorporated in the soil from the decomposed leaf litter has imparted a very dark grayish-brown to black color to the immediate surface layer.

If this soil is used for cultivated crops, the hazard of erosion is moderate. Practices that conserve moisture and that control erosion are needed. (Capability unit IVe-3, woodland suitability group 5)

Dunbarton silt loam, 6 to 12 percent slopes, moderately eroded (DuC2).—This is a sloping soil on the crests and side slopes of ridges. The slopes are generally plane or convex. The profile is less deep over fissured limestone than the profile described as representative for the series. Nearly all of the acreage is cultivated. In most of the cultivated areas, erosion has removed from one-third to two-thirds of the original surface layer. In some places all of the original surface layer has been removed by erosion, or the soil material is mixed by plowing. In those areas brownish soil material from the subsoil is exposed.

This soil is suited to all of the locally grown crops if erosion is controlled, and if good management is used. Practices that both conserve moisture and control erosion are needed, and contour stripcropping is the preferred practice. Yields of crops grown on this soil are reduced during extended dry periods. (Capability unit IVe-3, woodland suitability group 5)

Dunbarton silt loam, 12 to 20 percent slopes (DuD).—The profile of this moderately steep soil is similar to the one described for the series, but it is thinner and the surface layer has a darker color. This soil is commonly on the tops of narrow ridges, on the ends of ridges, or in other areas that are not generally well suited to farming or that are inaccessible. In most places it occupies narrow bands on convex slopes. It generally lies between areas of soils on the broader, more gently sloping ridgetops and areas of steeper Dubuque soils or of Steep stony and rocky land below. Most of the areas are wooded. In the wooded areas, a mat of leaves protects the surface layer from erosion and makes the infiltration of water more favorable. Organic matter from the decomposed

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leaf litter gives the surface layer a very dark grayish-brown or very dark brown color.

This soil is susceptible to severe water erosion, and it is also droughty. It is not suitable for row crops. High yields of hay and pasture are obtained, however, if enough lime and fertilizer are applied. The areas in forest are well suited to forest and should be managed for that use for sustained production of timber. (Capability unit VIe-3, woodland suitability group 5)

Dunbarton silt loam, 12 to 20 percent slopes, moderately eroded (DuD2).—This is a moderately steep soil on ridges below less sloping Dubuque soils. It receives some runoff from the less sloping soils. The areas in which it occurs are similar to those occupied by Dunbarton silt loam, 12 to 20 percent slopes. The profile of this soil is less deep over fissured dolomite than the one described for the series, and the surface layer is thinner than the one in the profile described. Also, the silty part of the profile is thinner in places. In some areas fragments of chert are on the surface and in the profile.

This soil is not suitable for cultivation, but nearly all of the acreage is cultivated. In most places from one-third to two-thirds of the original surface layer in the cultivated areas has been lost through erosion. In some spots brown material from the subsoil is exposed. Further erosion would make this soil less productive and more difficult to till.

This soil is moderately productive of forage crops if it is well managed. The cropping system should consist of forage crops grown for hay or pasture, and the areas should be renovated no oftener than 1 year in 5. Topdressing the meadows or pastures with fertilizer each year helps to increase the yields. (Capability unit VIe-3, woodland suitability group 5)

Dunbarton silt loam, 20 to 30 percent slopes (DuE).—This soil is wooded, and as a result, little or no erosion has taken place. The profile is thinner than the one described for the series. The silty upper part of the profile is also thinner.

This soil is too steep for cultivated crops, but it can be used for pasture or woodlots. Controlling grazing in the pastures helps to maintain a firm sod, and it guards against erosion. Protecting the woodlots from grazing, and managing for sustained production of timber, will help to provide a good cover for this soil. (Capability unit VIIe-3, woodland suitability group 5)

Dunbarton silt loam, 20 to 30 percent slopes, moderately eroded (DuE2).—The profile of this steep soil is thinner than the one described for the series. In most places the silty upper part of the profile is about 12 inches thick. The subsoil is brown to reddish brown and is cherty. It is thinner than that of uneroded Dunbarton soils that have similar slopes. In places limestone bedrock is at a depth of only 16 inches or less. Because of losses of soil material through erosion, the present surface layer is about 4 to 6 inches thick in most places. Some areas are marked by shallow gullies, however, and the clay loam subsoil is exposed in some spots. In a few other areas, dolomite crops out. Fragments of chert are common on the surface and throughout the profile.

This soil is suitable for pasture, trees, or use as areas for wildlife. Controlling grazing in the pastures helps to protect the sod and to guard against erosion. It is especially necessary in areas where gullies could be started by runoff in trails made by livestock. (Capability unit VIIe-3, woodland suitability group 5)

Dunbarton complex, 6 to 12 percent slopes (DvC).—In about 50 percent of the acreage of this mapping unit, the texture of the surface layer is loam, in about 45 percent it is silt loam, and in about 5 percent it is sandy loam. These soils are sloping and are on ridgetops, generally near the side slopes or ends of ridges where the layer of till is thin. Most of the areas have a rectangular shape. The slopes are between 50 and 100 feet long. The profiles of these soils are slightly shallower over bedrock than the profile described for the series.

These soils are very droughty and are moderately susceptible to erosion. They can be used to produce forage, as woodland, or to provide food and cover for wildlife. Yields of forage can be increased by topdressing the pastures and hayfields with fertilizer and renovating them when necessary. Controlling grazing helps to protect the sod. (Capability unit IVe-3, woodland suitability group 5)

Dunbarton complex, 6 to 12 percent slopes, moderately eroded (DvC2).—In about 50 percent of the acreage of this mapping unit, the texture of the surface layer is loam, in about 45 percent it is silt loam, and in about 5 percent it is sandy loam. In most places from one-third to two-thirds of the original surface layer has been lost through erosion and the color of the present surface layer is dark brown. In some spots, however, the subsoil is exposed and the texture of the surface layer is silty clay loam. Fragments of chert and limestone are common on the surface and throughout the profile.

These soils have about the same limitations as the soils in Dunbarton complex, 6 to 12 percent slopes. Management is also about the same, although bedrock is nearer the surface. Practices are needed to control further soil erosion and to slow deterioration of a soil that is already too shallow for crops to make good yields. (Capability unit IVe-3, woodland suitability group 5)

Dunbarton complex, 12 to 20 percent slopes (DvD).—The soils of this mapping unit generally occur in long, narrow areas along the side slopes of ridges. The length of the slopes ranges from 50 to about 100 feet. In about 50 percent of the acreage, the texture of the surface layer is loam, in about 45 percent it is silt loam, and in about 5 percent it is sandy loam. The profiles are similar to the one described as representative for the series, except that bedrock normally is at a depth of only 10 to 15 inches.

These soils are susceptible to severe water erosion and are droughty. They can be used for limited production of pasture, however; or as woodland; or as areas that provide food and cover for wildlife. Some of the areas are used for pasture, and others are in trees. Periodic renovation and topdressing of the pastured areas with fertilizer will increase the yields of forage. Controlling grazing helps to protect the sod. (Capability unit VIe-3, woodland suitability group 5)

Dunbarton complex, 12 to 20 percent slopes, moderately eroded (DvD2).—In about 50 percent of the acreage of these soils, the texture of the surface layer is loam, in about 45 percent it is silt loam, and in about 5 percent it is sandy loam. These soils have been cultivated or have

been intensively grazed. In most places they have lost from one-third to two-thirds of their original surface layer through erosion and their present surface layer is dark brown. The subsoil is exposed in some spots, however, and the texture of the surface layer in those areas is generally silty clay loam. Chert and fragments of limestone are common on the surface and throughout the profile.

Normally, the layer of clayey material weathered from limestone is nearer the surface and outcrops of the underlying limestone are more common than in areas of Dunbarton complex, 12 to 20 percent slopes. These soils have about the same limitations, however, as the soils in Dunbarton complex, 12 to 20 percent slopes, and management is similar. Practices that control erosion are needed. (Capability unit VIe-3, woodland suitability group 5)

Dunbarton complex, 20 to 30 percent slopes (DvE).—These steep soils are on the side slopes of ridges in the uplands. In about 50 percent of the acreage, the texture of the surface layer is loam, in about 45 percent it is silt loam, and in about 5 percent it is sandy loam. The layers in the profile are thinner than those in the profile described for the series. Outcrops of limestone bedrock are more numerous than in areas of less sloping Dunbarton soils. These soils vary greatly in depth. Included with them in mapping are small areas of Whalan soils, which are generally deeper than these soils.

The soils of Dunbarton complex, 20 to 30 percent slopes, are susceptible to severe erosion and are very droughty. They are suitable for trees or for wildlife habitats. They can also be used for pasture, but the yields of forage are low and the sod is difficult to maintain. All of the acreage is wooded or in pasture. Managing these soils for timber is more desirable than using them for grazing, although logging operations are difficult on the steep slopes. (Capability unit VIIe-3, woodland suitability group 5)

Dunbarton complex, 20 to 30 percent slopes, moderately eroded (DvE2).—In about 50 percent of the acreage of these soils, the texture of the surface layer is loam, in about 45 percent it is silt loam, and in about 5 percent it is sandy loam. In most places these soils have lost from one-third to two-thirds of their original surface layer through erosion. The present surface layer is lighter colored than the original one, and it is also finer textured in areas where the subsoil is exposed. Chert and fragments of limestone are common on the surface and throughout the profile. Bedrock crops out in many places.

The limitations of these shallow soils are similar to those of the soils in Dunbarton complex, 20 to 30 percent slopes, and management is similar. Control of erosion is of prime importance. (Capability unit VIIe-3, woodland suitability group 5)

Edith Series

The Edith series consists of soils that are excessively drained, dark colored, and gravelly (fig. 12). These soils are underlain by glacial drift that has been extensively washed and that has been sorted to some extent by water from melting glaciers. In places the drift contains layers of cemented material. These soils are sloping to steep and are on hilly uplands.

***Figure 12.*—Profile of Edith sandy loam. In the Edith soils, the horizons are not distinct.**

Where the Edith soils occur in the northwestern part of the county, the texture of their surface layer is loam, gravelly loam, or sandy loam. In that part of the county, these different soil types are so intermingled that mapping them separately is not feasible. The Edith soils in the northwestern part of the county generally have a darker colored thicker surface layer than the ones in the northern and eastern parts. Also, they have a less acid substratum and contain more layers of strongly cemented gravel.

In the northern and eastern parts of the county, the Edith soils occur with areas of Wykoff loams and are mapped in complexes with those soils. In those areas their surface layer is predominantly very dark brown and is variable in texture. The profile is similar to the one described for the Edith series. A profile that is typical for the Wykoff soils is described under the Wykoff series.

Representative profile of a cultivated Edith gravelly loam:

0 to 6 inches, very dark brown, very friable gravelly loam.
6 to 12 inches, dark-brown, very friable gravelly loam.
12 to 42 inches +, dark-brown, loose gravelly sandy loam.

The Edith soils have rapid permeability and rapid internal drainage. They have low available moisture capac-

ity. The depth to which the roots of most crops can penetrate is rather shallow, although the cemented layers are generally below the depth needed for the penetration of roots. Natural fertility is low.

Because of their limited potential for good yields and the hilly topography of the areas in which they occur, the Edith soils are not used extensively for crops. They have some economic importance as a source of gravel.

Edith soils, 6 to 12 percent slopes, eroded (EdC2).—In much of the acreage, the soils of this mapping unit have a profile similar to the one described for the series. Although the color of the surface layer is dominantly very dark brown, part of the friable soil material in the original surface layer has been lost through erosion.

The rate of infiltration is slow. Therefore, these soils are slightly more droughty than the less eroded Edith soils. Also, they have lost part of their natural fertility as a result of erosion. In many places the content of organic matter is low. The hazard of further erosion is severe. Included in mapped areas of these soils are small areas of Edith soils, 6 to 12 percent slopes.

Forage crops can be grown on Edith soils, 6 to 12 percent slopes, eroded, and these soils are suitable for trees or as habitats for wildlife. The areas used for pasture can be protected from further erosion by guarding against overgrazing. The cover of plants that is left after the pastures are grazed should be dense enough that the sod is maintained. Topdressing with fertilizer helps to maintain a good cover of sod and increases the yields of forage. (Capability unit VIs-5, woodland suitability group 12)

Edith soils, 12 to 20 percent slopes (EdD).—This mapping unit consists of a mixture of Edith gravelly loam, Edith loam, and Edith sandy loam. The soils are moderately steep and are on kames and eskers, on the side slopes of ridges, and in scattered areas within larger areas of Ostrander and Racine soils. On the kames and eskers, the slopes are convex, and they are complex in many places. The surface layer is darker colored than the one in the profile described for the series. It is black in most areas that have not been disturbed. In most places the surface layer is 6 to 12 inches thick.

The rate of infiltration is moderate, but the available moisture capacity is low and these soils are very droughty. Runoff is rapid, and the hazard of erosion is very severe. Serious gullying can occur unless the soils are protected.

These soils are suited to limited use for pasture, and they can be used as woodland or to provide food and cover for wildlife. The pastures need protection from overgrazing. A good cover of plants should be maintained in the pastures at all times so that the sod will not deteriorate. (Capability unit VIs-5, woodland suitability group 12)

Edith soils, 12 to 20 percent slopes, moderately eroded (EdD2).—These soils have lost from one-third to two-thirds of their original surface layer through erosion. The present surface layer is dominantly very dark brown and is 6 to 10 inches thick. Part of the organic matter that was in the original surface layer has been lost as the result of erosion. The present surface layer is less friable and less porous than the original one, and it is lower in natural fertility.

Rapid runoff and a slower rate of infiltration make these soils more droughty than Edith soils, 12 to 20 percent slopes. Where tilth is poor and the surface layer is low in fertility, practices are especially needed to control further erosion. Although only limited grazing should be allowed, these soils are suited to pasture. They can also be used as woodland or for areas for wildlife. (Capability unit VIs-5, woodland suitability group 12)

Edith soils, 20 to 30 percent slopes (EdE).—This mapping unit consists of a mixture of steep areas of Edith gravelly loam, Edith loam, and Edith sandy loam. The soils are mainly on kames and eskers. To a lesser extent, they occupy the side slopes of ridges and scattered spots within larger areas of Ostrander and Racine soils. These soils have convex slopes, and some of the slopes are complex in areas on kames and eskers. The surface layer of these soils is darker colored and slightly thicker than the one in the profile described for the series. In areas that have not been disturbed, the surface layer is black and is about 8 inches thick.

Runoff is very rapid, and these soils are susceptible to severe erosion. They are very droughty.

These soils are suitable for trees and for providing food and cover for wildlife. They can also be used for pasture, but the yields of forage are low and the cover of sod is hard to maintain. (Capability unit VIIs-5, woodland suitability group 12)

Edith-Wykoff soils, 6 to 12 percent slopes, eroded (EwC2).—About 40 percent of this mapping unit is Edith gravelly loam, and about 60 percent is Wykoff loam. The Edith soil has a profile similar to the one described for the Edith series, but part of the friable surface layer has been lost through erosion. The rate of infiltration, natural fertility, content of organic matter, susceptibility to further erosion, and tendency to droughtiness are all similar to those of Edith soils, 6 to 12 percent slopes, eroded.

The Wykoff soil has a profile similar to the one described for the Wykoff series. In most places, however, it has lost from one-third to two-thirds of its original surface layer through erosion, and consequently the profile is less deep over gravelly loam. The present surface layer is generally 4 to 8 inches thick, but dark-brown subsoil material is exposed in places. The content of organic matter, susceptibility to further erosion, and tilth are similar to those of Wykoff loam, 6 to 12 percent slopes, moderately eroded.

Included in mapped areas of these soils are areas of other Edith soils. Also included are areas of gently sloping soils that have a subsoil of gravelly heavy loam. (Capability unit IVe-3, woodland suitability group 5)

Edith-Wykoff soils, 12 to 20 percent slopes, eroded (EwD2).—About half of this mapping unit consists of Edith gravelly loam, and about half, of Wykoff loam. The Edith soil has a profile similar to the one described for the Edith series, except that from one-third to two-thirds of the original surface layer has been lost through erosion. The present surface layer is dominantly very dark brown and is 6 to 10 inches thick. Runoff is rapid, and the rate of infiltration, natural fertility, tilth, and susceptibility to further erosion are similar to those of Edith soils, 12 to 20 percent slopes, moderately eroded.

The Wykoff soil has a profile similar to the one described for the Wykoff series, except that from one-third to two-thirds of the original surface layer has been lost through erosion. The present surface layer is 4 to 8 inches thick. It has a brownish color, because part of the subsoil has been mixed with the surface soil by tillage. The content of organic matter in the surface layer, the tilth, and the susceptibility to erosion are similar to those of Wykoff loam, 12 to 20 percent slopes, moderately eroded.

Included in mapped areas of this complex are areas of Edith loam and of Edith sandy loam. Other included soils have a subsoil of gravelly heavy loam. (Capability unit VIs-5, woodland suitability group 5)

Edith-Wykoff soils, 12 to 20 percent slopes, severely eroded (EwD3).—This mapping unit is composed of about equal parts of Edith gravelly loam and Wykoff loam. The profile of the Edith soil is similar to the one described for the Edith series, except that it has a lighter color and is thinner. In places most of the surface layer has been lost through erosion. The Wykoff soil has a profile similar to the one described for the Wykoff series, except that more than two-thirds of the original surface layer has been lost through erosion. The present surface layer is generally dark brown and is less than 4 inches thick. It consists mainly of material that was formerly part of the subsoil and that is low in content of organic matter and in poor tilth. In places glacial drift is exposed in small areas, and the surface layer is gravelly and cobbly in places. The rate of water infiltration is slow, there is a large amount of runoff, and the hazard of further erosion is severe.

The soils of this complex are suitable for trees or for use as areas to provide food and cover for wildlife. Limitations to their use for pasture are severe. (Capability unit VIIs-5, woodland suitability group 5)

Edith-Wykoff soils, 20 to 30 percent slopes (EwE).—About 60 percent of this mapping unit is Edith gravelly loam, and 40 percent is Wykoff loam. These soils are primarily on kames and eskers. To a lesser extent, they occupy the side slopes of ridges and occur in scattered spots within larger areas of Ostrander and Racine soils.

The Edith soils have a profile similar to the one described for the Edith series, but the surface layer is darker colored and slightly thicker. In areas that have not been disturbed, the surface layer is black and is about 8 inches thick. The Wykoff soil has a profile similar to the one described for the Wykoff series, but the profile is less deep over the layer of gravelly loam. Runoff is very rapid, and the hazard of erosion is severe.

The soils of this unit are suited to use as woodland, pasture, or areas for providing food and cover for wildlife. Much of the acreage is wooded. (Capability unit VIIs-5, woodland suitability group 5)

Fayette Series

The Fayette series consists of deep, well-drained soils that are medium textured and are nearly level to steep. These soils have formed on high stream terraces, or benches, in a layer of silty material more than 42 inches thick. The largest areas are along Plum Creek.

Representative profile of Fayette silt loam, benches:

0 to 10 inches, dark grayish-brown, friable silt loam.
10 to 23 inches, dark yellowish-brown, friable silt loam.
23 to 42 inches, dark-brown, firm silt loam.
42 inches +, dark yellowish-brown, friable silt loam.

These soils are not extensive, but they are highly desirable for agriculture. Their natural fertility is moderately high. Permeability is moderate, and the available moisture capacity is high. These soils are medium acid to very strongly acid. The penetration of roots is not restricted.

Fayette silt loam, benches, 0 to 2 percent slopes (FaA).—This soil has a profile like the one described for the series. It occupies broad, nearly level areas, and it is only slightly subject to erosion.

This soil is suited to all of the crops commonly grown in the county. If a suitable cropping system is used, and if enough fertilizer is applied, the soil can be cropped intensively and yields are generally high. Corn, oats, and alfalfa-brome hay are the principal crops. This soil is not susceptible to erosion, and no special practices are needed to protect it. In many places yields are limited by lack of organic matter and nitrogen. The crops respond well to applications of a complete fertilizer. Enough lime should be added to reduce the acidity of this soil to nearly neutral. (Capability unit I-1, woodland suitably group 1)

Fayette silt loam, benches, 2 to 6 percent slopes (FaB).—This soil is on the broad, gently sloping parts of stream terraces. It has retained nearly all of its original surface layer, and it absorbs water well. Therefore, runoff is not a serious problem. Included in mapped areas of this soil are small areas of Fayette silt loam, benches, 2 to 6 percent slopes, moderately eroded.

Most of the acreage is used for crops, but a few areas that are not accessible remain in trees. This soil is well suited to corn, oats, and hay. If practices that control erosion and that maintain a high level of organic matter and plant nutrients are used, sustained high yields can be obtained in areas that are intensively cropped. (Capability unit IIe-1, woodland suitability group 1)

Fayette silt loam, benches, 6 to 12 percent slopes, moderately eroded (FaC2).—The profile of this soil is similar to the one described for the series, but the surface layer is thinner and lighter colored. In most places from one-third to two-thirds of the original surface layer has been lost through erosion and the present surface layer is 5 to 8 inches thick. If this soil is plowed, dark-brown or dark yellowish-brown material from the subsoil is turned up in about half of the cultivated acreage.

Included in mapped areas of this soil are a few small areas in which the slope is moderately steep. In a few other small included areas, erosion has been severe.

Careful management is required to prevent further erosion. If this soil is used for crops, the supply of plant nutrients should be maintained. Row crops can be grown no oftener than 1 year out of 4. The crops respond well if a complete fertilizer is applied. Turning under a green-manure crop and adding barnyard manure will increase the content of organic matter and add nitrogen. In cultivated areas liming is suggested. The amount of

lime needed should be determined by soil tests. (Capability unit IIIe–1, woodland suitability group 1)

Floyd Series

The Floyd series consists of somewhat poorly drained silt loams that are underlain by glacial till. These soils are in shallow depressions and in drainageways in the uplands. They occur mainly in the northwestern part of the county, where most of the soils are dark colored.

Representative profile of Floyd silt loam in a drainageway. In this profile about 10 inches of silty material has been deposited over a surface layer that contains a large amount of organic matter.

0 to 21 inches, very dark gray and black, very friable silt loam.
21 to 24 inches, very dark gray, firm silty clay loam; dark yellowish-brown mottles.
24 to 40 inches, dark grayish-brown, firm clay loam; many, fine, dark-brown mottles.
40 inches +, dark-brown, firm clay loam; many, fine, grayish-brown mottles.

The Floyd soils occupy positions favorable for receiving runoff from the adjoining areas. Surface drainage is slow. Permeability is moderately slow, and internal drainage is slow. The available moisture capacity is high. These soils range from neutral to medium acid in reaction. The depth favorable for the penetration of roots depends on the wetness of the soils. As a rule, roots can penetrate to a depth of 18 to 30 inches.

In Pierce County the individual areas of Floyd soils are rather small and these soils are not important for farming. Many of the areas are too wet for good yields, but these soils are well suited to crops if the drainage has been improved. Some areas occur in drainageways that serve as a natural boundary of a field. Those areas have been left in permanent pasture.

Floyd silt loam, 2 to 6 percent slopes (FlB).—This is the only Floyd soil mapped in Pierce County. It has gentle slopes that are concave and that are mainly no steeper than 4 percent. Most of the areas are only a few acres in size. Their shape generally conforms to the drainage pattern of the uplands. The areas are divided by natural waterways, and the slopes dip toward these waterways. A rather small acreage of this soil occurs with light-colored Renova and Vlasaty soils in the north-central part of the county. In places in that part of the county, this soil has characteristics of a poorly drained soil.

Excess water is a hazard where drainage has not been improved, and erosion is a slight hazard if this soil is used for cultivated crops. Improving the surface drainage and using a cropping system that helps to control erosion are beneficial. Diversions can be used to intercept runoff from the adjoining areas. If adequate drainage is provided, a suitable cropping system is one in which a row crop, a small grain, and hay are grown for 1 year each. If drainage has not been improved, this soil can be used for hay or pasture, or it can be used to provide food and cover for wildlife. (Capability unit IIw–1, woodland suitability group 12)

Freeon Series

The Freeon series consists of silty soils that are moderately well drained. These are gently sloping or sloping soils that are 12 to 30 inches deep over glacial till. They occupy scattered areas on ridgetops in the northern part of the county.

Representative profile of cultivated Freeon silt loam:

0 to 14 inches, very dark grayish-brown, friable silt loam; few, fine, dark yellowish-brown mottles in lower part of layer.
14 to 18 inches, dark-brown, friable silt loam; many dark yellowish-brown mottles.
18 to 25 inches, grayish-brown and dark-brown, friable gritty silt loam.
25 to 36 inches +, reddish-brown, firm loam glacial till.

Freeon soils have moderately slow permeability and medium internal drainage. Available moisture capacity is moderate. These soils are slightly acid to strongly acid. Natural fertility is moderate, and the soils do not have a restricted root zone. The acreage is not extensive enough, however, for these soils to be important for farming.

Freeon silt loam, 2 to 6 percent slopes, moderately eroded (FnB2).—This soil has a profile like the one described for the series. Its slopes are gentle and are concave or plane.

Permeability is moderately slow. As a result, a large amount of water runs off this soil, especially during periods of heavy rainfall. There is a slight hazard of further water erosion. Cropping can be fairly intensive, however, if suitable practices are applied to control erosion. (Capability unit IIe–1, woodland suitability group 1)

Freeon silt loam, 6 to 12 percent slopes, moderately eroded (FnC2).—Erosion has removed from 3 to 6 inches of the original surface layer of this sloping soil, and the present surface layer is 6 to 12 inches thick. The profile is similar to the one described for the series, except for the thinner surface layer. Included in mapped areas of this soil is a small acreage in which erosion has been only slight.

The hazard of further erosion is moderate, but row crops can be grown if practices are used to control erosion. A suitable cropping system is one in which meadow crops are grown most of the time. (Capability unit IIIe–1, woodland suitability group 1)

Freer Series

The soils of the Freer series are somewhat poorly drained and are silty. Their profile consists of layers of silt loam that, combined, are 12 to 30 inches thick over glacial till. These soils are nearly level. They occur in scattered areas on ridgetops in the northern part of the county.

Representative profile of a cultivated Freer silt loam:

0 to 7 inches, black, firm silt loam.
7 to 18 inches, grayish-brown, friable silt loam; many yellowish-brown mottles.
18 to 23 inches, grayish-brown, firm loam glacial till; many reddish-brown mottles.
23 to 36 inches +, dark-brown and reddish-brown, friable loam.

Freer soils have moderately slow permeability and slow internal drainage. The available moisture capacity is high, but natural fertility is moderately low. These soils are slightly acid to strongly acid. In Pierce County they occupy only a small acreage and are not important for farming.

Freer silt loam (0 to 3 percent slopes) (Fr).—This is the only soil of the Freer series mapped in this county. It occurs in upland drainageways, where it receives water from adjoining areas. The profile is the one described for the series.

Surface drainage is slow, and this nearly level soil contains a slowly permeable layer. Water is removed slowly enough that the soil is wet for significant periods. Drainage is needed for optimum yields.

Cropping can be fairly intensive if suitable practices are used to control the water. Row crops can be grown 1 year out of 3 if this soil is well managed. However, the content of organic matter and the supply of plant nutrients must be kept high, tillage must be kept to a minimum, and good tilth and good soil structure must be preserved. (Capability unit IIw–4, woodland suitability group 7)

Gale Series

The Gale series is composed of silty, well-drained soils that are nearly level to steep. These soils have formed in a mantle of windblown silty material (loess) that is 24 to 42 inches thick over sand or sandstone. They are on the uplands.

Representative profile of a cultivated Gale silt loam:

0 to 10 inches, very dark grayish-brown, friable silt loam.
10 to 14 inches, dark-brown, friable silt loam.
14 to 24 inches, dark yellowish-brown, firm silt loam.
24 to 30 inches, yellowish-brown, friable loam.
30 to 42 inches +, light yellowish-brown, loose sand.

The Gale soils are moderately permeable and have medium available moisture capacity. In the areas that are cultivated, the surface layer is medium acid to strongly acid, except where these soils have received lime. In some undisturbed areas, however, the surface layer has nearly neutral reaction. In places roots can penetrate to the substratum of loose sand. These soils have high natural fertility. Crops grown on them respond well to applications of fertilizer.

These soils are significant to the agriculture of the county. They are suited to all the crops commonly grown.

Gale silt loam, 2 to 6 percent slopes (GaB).—This is a gently sloping soil on plains in the uplands. Its profile is like the one described for the series. Included in areas mapped as this soil is a small acreage of a nearly level Gale silt loam.

Gale silt loam, 2 to 6 percent slopes, is slightly susceptible to erosion. Runoff is rather slow, however, and only simple practices are required to provide protection. Loose sand is at a greater depth than in the more sloping soils. This soil has a rather high content of organic matter in the surface layer. The natural fertility and available moisture capacity are higher than in the steeper Gale soils.

This soil is suited to all the crops grown locally. Only simple practices are required to maintain good tilth. Drought, as well as erosion, is a slight hazard. (Capability unit IIe–2, woodland suitability group 1)

Gale silt loam, 2 to 6 percent slopes, moderately eroded (GaB2).—This soil has lost from one-third to two-thirds of its original surface layer through erosion. The present surface layer is lighter colored than the original one because part of the subsoil has been mixed with the surface soil by tillage. Losing organic matter as the result of erosion has caused the tilth to be poor, has lowered the fertility, and has made the rate of infiltration slower. The crops grown are similar to those grown on Gale silt loam, 2 to 6 percent slopes, and limitations and management are about the same. (Capability unit IIe–2, woodland suitability group 1)

Gale silt loam, 6 to 12 percent slopes, eroded (GaC2).—This soil has lost from one-third to two-thirds of its original surface layer through erosion. Its profile is slightly thinner than the one described as representative for the series, and the surface layer is lighter colored. Included in mapped areas of this soil are small areas of Gale silt loam, 6 to 12 percent slopes.

Because of the loss of organic matter from the surface layer and the mixing of soil material from the surface layer and subsoil by tillage, the present surface layer of Gale silt loam, 6 to 12 percent slopes, eroded, has poorer tilth than the original one. The natural fertility is also lower, and the rate of infiltration is slower. (Capability unit IIIe–2, woodland suitability group 1)

Gale silt loam, 12 to 20 percent slopes, moderately eroded (GaD2).—This soil has been cultivated without using practices to control erosion. As a result, it has lost from one-third to two-thirds of its original surface layer through erosion. The present surface layer is lighter colored than the surface layer of Gale soils that are not eroded, and loose sand is nearer the surface. Included in mapped areas of this soil are small areas of Gale silt loam, 12 to 20 percent slopes.

The loss of organic matter from the surface layer and the slower rate of infiltration, caused by poorer tilth, have slightly reduced the potential for good yields of crops grown on Gale silt loam, 12 to 20 percent slopes, moderately eroded. Most of the areas are in crops. Erosion control practices are needed, however, where this soil is cultivated. A cropping system in which forage crops are grown most of the time helps to control erosion and to maintain good tilth. Moderately high yields can be obtained if enough lime and fertilizer are applied. (Capability unit IVe–2, woodland suitability group 1)

Gale Series, Thin Solum Variants

Thin solum variants of the Gale series are like the soils of the Gale series in many respects, but they differ in some characteristics. Unlike the normal Gale soils, they are moderately shallow over thinly layered siltstone and fine sandstone. These variants are well drained and are silty. They are gently sloping to steep and occur on uplands and on valley slopes. The soils are in the southwestern corner of Rock Elm Township, in a valley that occupies 9 square miles. The areas occur at the confluence of two streams in the watershed of Plum Creek.

Representative profile of Gale silt loam, thin solum variant:

0 to 7 inches, very dark grayish-brown, friable silt loam.
7 to 16 inches, yellowish-brown, firm silt loam; has many fragments of sandstone in pockets and layers.
16 to 20 inches, pale-brown weathered siltstone; has many fragments of sandstone in pockets and in layers.
20 inches +, very pale brown, interlayered and thinly bedded siltstone and sandstone.

Thin solum variants of the Gale series are moderately permeable. Internal drainage is moderately rapid, and the available moisture capacity is low. The soils are medium acid to strongly acid. Natural fertility is moderate.

These soils are used mainly for permanent pasture or are wooded. They are not significant to the agriculture of the county. If they are used for crops, large applications of lime are generally needed. After the soils are limed, the crops respond well to applications of fertilizer.

Gale silt loam, thin solum variant, 6 to 12 percent slopes, eroded (GtC2).—This is a sloping soil on the tops of hills, on secondary ridges, and in narrow bands along the sides of ridges. Its profile is similar to the one described as representative for the thin solum variants of the Gale series, but the surface layer is lighter colored. The surface layer is dominantly grayish brown and is about 6 to 8 inches thick.

About 18 acres of a soil that has a similar profile, but that is moderately well drained or somewhat poorly drained, is included in the mapped areas of this soil. This included soil occurs in small, scattered seepage spots. Also included is a rather small acreage in which the soil is wooded and is not eroded.

The hazard of erosion is moderate, and Gale silt loam, thin solum variant, 6 to 12 percent slopes, eroded, is not well suited to row crops. If contour stripcropping is practiced, however, row crops may be grown where the slopes are short. (Capability unit IVe-3, woodland suitability group 5)

Gale silt loam, thin solum variant, 12 to 20 percent slopes (GtD).—This soil is on hillsides and in narrow bands along the sides of ridges. Trees have protected most of the areas from erosion. Therefore, the surface layer has retained most of its original content of organic matter. The profile is like the one described as representative for the thin solum variants of the Gale series.

This soil is susceptible to severe water erosion. Runoff is rapid because of the moderately steep slopes. As a result, this soil is more droughty than the less sloping variants of the Gale series. It is not well suited to cultivation, even if practices are used to protect it from erosion. It can be used for meadow, pasture, or trees, or it can be used for areas that provide food and cover for wildlife. (Capability unit VIe-3, woodland suitability group 5)

Gale silt loam, thin solum variant, 12 to 20 percent slopes, moderately eroded (GtD2).—This soil occurs in areas similar to those occupied by Gale silt loam, thin solum variant, 12 to 20 percent slopes. It has been cultivated. As a result, it has lost a large part of the original surface layer through erosion. The profile is generally thinner than the profile described as representative, and the surface layer is dominantly grayish brown. The surface layer is about 5 to 7 inches thick. Limitations are similar to those of Gale silt loam, thin solum variant, 12 to 20 percent slopes.

If this soil is used for pasture, grazing should be controlled so that a good cover of plants remains. Controlling grazing and topdressing with fertilizer help to maintain a firm sod. The fertilizer also greatly increases the yields of forage. Gullying is likely to start in cattle trails if runoff is allowed to concentrate. (Capability unit VIe-3, woodland suitability group 5)

Gale silt loam, thin solum variant, 20 to 30 percent slopes (GtE).—This soil occurs mainly in narrow bands along the sides of hills and ridges. The areas are mostly in trees and are not susceptible to erosion. In the wooded areas, the surface is covered with leaves that help to absorb water and reduce runoff. The profile is shallower over bedrock of siltstone and sandstone than the profile described for the thin solum variants of the Gale series. Included in areas mapped as this soil are small areas of Gale silt loam, 20 to 30 percent slopes.

The steep slopes make Gale silt loam, thin solum variant, 20 to 30 percent slopes, unsuitable for tilled crops. This soil should be kept in permanent vegetation, such as hay or pasture, or it can be used as woodland and for areas to provide food and cover for wildlife. (Capability unit VIIe-3, woodland suitability group 5)

Halder Series

The Halder series consists of moderately deep, somewhat poorly drained soils that are underlain by outwash sand and gravel. These soils are nearly level. They are on low stream terraces, mainly along Lost Creek near the town of Lawton.

Representative profile of Halder loam:

0 to 8 inches, very dark grayish-brown, friable loam.
8 to 11 inches, dark grayish-brown, friable loam; faint, dark yellowish-brown mottles and some stones.
11 to 20 inches, dark-brown, friable loam; many, coarse, dark-brown and grayish-brown mottles and a small amount of gravel.
20 to 23 inches, dark-brown, firm sandy clay loam; many, coarse, dark-brown and grayish-brown mottles and a small amount of gravel.
23 to 32 inches, dark-brown and grayish-brown, friable sandy loam and a small amount of fine gravel.
32 to 42 inches +, dark-brown, loose, layered, medium and fine gravel.

The Halder soils have high available moisture capacity. Permeability is moderate in the loamy upper part of the profile, but it is rapid in the lower part. The root zone extends downward to the gravelly substratum.

Because of their rather small acreage in Pierce County, these soils are not important for farming. They are used mainly for crops or pasture.

Halder loam, 0 to 2 percent slopes (HaA).—This soil has a profile similar to the one described for the series. In many places it receives runoff from the adjacent areas. Surface drainage is slow, and some ponding occurs after heavy rains.

If this soil is adequately drained, it can be used with moderate intensity. Surface drains, diversions, and waterways to remove the excess water generally result in better and more sustained yields. The undrained areas can be used to limited extent for forage crops and small grains, but wetness may delay fieldwork in spring. (Capability unit IIw-5, woodland suitability group 7)

Halder loam, sandy substratum, 0 to 3 percent slopes (HdA).—This soil is on stream terraces in drainageways and in slight depressions. It occurs within larger areas of Gale, Hixton, and Arland soils but at a lower elevation than those soils. It is also adjacent to Onamia and other Halder soils. The somewhat poor drainage is caused by water that accumulates over a very slowly permeable layer at a depth below about 60 inches.

Because this soil is wet, it is slower to warm up in spring than well-drained soils. In the nearly level areas

that are subject to ponding, and that do not have adequate natural drainage, open ditches are suggested to drain off the excess water. Where this soil is adequately drained, it can be farmed with moderate intensity. The areas that have not been drained can be used to limited extent for forage crops and small grains, or they can be used for pasture. (Capability unit IIw–5, woodland suitability group 7)

Hesch Series

The Hesch series consists of soils that are deep and well drained. These soils have formed in medium-textured material over material weathered from sandstone. They are gently sloping to moderately steep and are on valley slopes in the northwestern part of the county. Within their sandy substratum is a layer that is finer textured than the layers immediately above and below. The texture of this layer ranges from sandy loam to sandy clay loam. Varying amounts of sandstone and limestone fragments are on the surface and throughout the profile.

Representative profile of a cultivated Hesch fine sandy loam, loamy substratum:

0 to 10 inches, very dark grayish-brown, friable fine sandy loam.
10 to 14 inches, dark-brown, friable fine sandy loam.
14 to 18 inches, dark-brown, friable loam.
18 to 23 inches, dark-brown, friable fine sandy loam.
23 to 28 inches, dark yellowish-brown, loose loamy fine sand.
28 to 34 inches, dark-brown, firm heavy loam.
34 to 50 inches +, dark yellowish-brown, firm sandy clay loam.

The Hesch soils have moderate to moderately rapid permeability and high available moisture capacity. Their reaction is neutral to slightly acid. The root zone is deep enough for most crops. Natural fertility is moderate to moderately low.

Hesch fine sandy loam, loamy substratum, 2 to 6 percent slopes, moderately eroded (HeB2).—This is a gently sloping soil on upland plains and valley slopes. Its profile is the one described for the series. It has lost from one-third to two-thirds of its original surface layer through erosion. In places the layer of loamy fine sand is at a depth a few inches greater than in the profile described for the series. Small areas in which the texture of the surface layer is loamy fine sand are included in mapped areas of this soil.

The amount of runoff is low, and water erosion is a slight hazard. This soil is droughty, but the available moisture capacity is slightly higher than that of the steeper Hesch soils. Part of the organic matter has been lost from the surface layer. Also, the natural fertility has been somewhat lowered as a result of erosion.

This soil is suited to the crops grown locally, and only fairly simple management practices are required to maintain good tilth. Practices that protect the soil from wind erosion, that conserve moisture, and that maintain the content of organic matter and the supply of plant nutrients are suggested for sustained good yields. Where feasible, irrigation can be used to advantage. (Capability unit IIe–7, woodland suitability group 3)

Hesch fine sandy loam, loamy substratum, 6 to 12 percent slopes, moderately eroded (HeC2).—This soil has been cultivated and has lost from one-third to two-thirds of its original surface layer through erosion. It has stronger slopes than the soil for which a profile is described for the series. The present surface layer is lighter colored and thinner than that of an uneroded Hesch soil. Natural fertility has also been reduced by erosion.

Included in mapped areas of this soil is a rather small acreage in which the soil is not eroded. Also included are areas in which the texture of the surface layer is loamy fine sand.

This Hesch soil is moderately susceptible to water erosion and is slightly susceptible to wind erosion. It is also slightly droughty. Row crops should be grown only if stripcropping or other suitable practices are used to protect the soils. (Capability unit IIIe–7, woodland suitability group 3)

Hesch fine sandy loam, loamy substratum, 12 to 20 percent slopes, eroded (HeD2).—The profile of this soil is shallower over sandstone than the profile of less sloping Hesch soils. In many places where this soil is on the side slopes of valleys, it has fragments of sandstone on the surface and throughout the profile.

Included in mapped areas of this soil are small areas of Hesch fine sandy loam, loamy substratum, 12 to 20 percent slopes. Also included is a rather small acreage in which the texture of the surface layer is loamy fine sand.

Most of the acreage is used for crops, although limitations are severe for growing row crops. Where this soil is cultivated, practices are needed that control erosion. A large part of the cropping system should consist of hay crops. Also, keeping tillage to a minimum is beneficial. (Capability unit IVe–7, woodland suitability group 3)

Hesch loam, loamy substratum, 2 to 6 percent slopes (HlB).—This soil is on upland plains and valley slopes. Its surface layer is thicker than, but not so dark colored as, the one in the profile described for the series. Also, loose, sandy material is at a greater depth. This is a gently sloping soil; most of the slopes are between 2 and 4 percent. Erosion has not been extensive enough to be noticeable. Included in the areas mapped as this soil is a rather small acreage of a soil that has a similar profile but that is nearly level.

Runoff is slow. Erosion is only a slight hazard, and the hazard of drought is slight. The content of organic matter is rather high, and the natural fertility and the available moisture capacity are higher than those of the steeper Hesch soils.

This soil is suited to all of the locally grown crops. Only simple practices are needed to help to control erosion and to maintain good yields. (Capability unit IIe–1, woodland suitability group 12)

Hesch loam, loamy substratum, 2 to 6 percent slopes, moderately eroded (HlB2).—This soil occurs in areas similar to those occupied by Hesch loam, loamy substratum, 2 to 6 percent slopes. Its slopes are mainly between 4 and 6 percent. This soil has been cultivated and has lost from one-third to two-thirds of its original surface layer through erosion. In most places the surface layer is lighter colored, has a lower content of organic matter, and has lower natural fertility than that of Hesch loam, loamy substratum, 2 to 6 percent slopes. The limitations of these two soils are similar, however, and the management used and the crops grown are similar. (Capability unit IIe–1, woodland suitability group 12)

Hesch loam, loamy substratum, 6 to 12 percent slopes, moderately eroded (HlC2).—This soil has lost from one-third to two-thirds of its original surface layer through erosion. The present surface layer is lighter colored than the surface layer in the profile described for the series. Also, outwash sand and gravel are normally a little nearer the surface. Included in mapped areas of this soil are a few acres in which erosion has been only slight.

The hazard of further erosion is moderate, and this moderately eroded soil is slightly droughty. If row crops are grown, practices are needed to prevent further erosion. Practices that conserve moisture also help to maintain good yields. (Capability unit IIIe-1, woodland suitability group 12)

Hesch loam, loamy substratum, 12 to 20 percent slopes, moderately eroded (HlD2).—This soil has a profile similar to the one described for the series, except that the surface layer is thicker and is slightly lighter colored. This soil is cultivated or has been cultivated. From one-third to two-thirds of the original surface layer has been lost through erosion. As a result, part of the content of organic matter and part of the natural fertility have been lost. In most places numerous fragments of sandstone are on the surface and throughout the profile. Included in mapped areas of this soil is a rather small acreage in which the soil has not been eroded.

The hazard of further erosion is severe, and Hesch loam, loamy substratum, 12 to 20 percent slopes, moderately eroded, is slightly droughty. If this soil is cultivated, it is suited mainly to small grains and hay. Beneficial practices consist of keeping tillage to a minimum and using a cropping system made up mainly of hay crops. (Capability unit IVe-1, woodland suitability group 12)

Hixton Series

The Hixton series consists of moderately deep soils that are well drained. These soils are gently sloping to moderately steep and have formed in medium-textured material over material weathered from sandstone. Some of them are on rolling hills in the north-central part of the county. Others, which are underlain by loamy material, are on valley slopes in the northwestern part of the county.

Representative profile of Hixton loam:

0 to 8 inches, very dark grayish-brown, friable loam; lower part grayish brown.
8 to 16 inches, dark-brown, friable loam.
16 to 36 inches, dark yellowish-brown, firm loam.
36 to 65 inches +, brownish-yellow and pale-brown, loose fine sand.

Hixton soils have moderate to moderately rapid permeability. Where the substratum is loamy, the available moisture capacity is moderate, but it is moderately low in other places. Natural fertility is moderate to moderately low. The reaction ranges from medium acid to neutral. Except where sandstone is fairly near the surface, the depth to which roots can penetrate is not restricted.

Hixton fine sandy loam, 6 to 12 percent slopes, moderately eroded (HmC2).—This soil is commonly on the tops of rolling hills, but some areas are on valley slopes. As much as two-thirds of the original surface layer has been lost through erosion. The profile is similar to the one described for the series. A few small areas of a more severely eroded Hixton fine sandy loam are included in mapped areas of this soil.

Hixton fine sandy loam, 6 to 12 percent slopes, moderately eroded, is used mainly for cultivated crops. It is not suitable for intensive tillage, but fair yields of small grains and hay are obtained if management is good. Where cultivated crops are grown, special practices are needed to control further erosion. Natural fertility is moderately low. Lime and fertilizer are necessary, and the cropping system should consist of crops that help to supply organic matter. Practicing contour stripcropping and using a cropping system consisting of 1 year of a row crop, 1 year of a small grain, and 3 years of meadow will adequately control erosion and will help to conserve moisture. Yields of crops grown on this soil are reduced during periods of low rainfall or during seasons when rainfall is poorly distributed.

In the included spots occupied by a severely eroded Hixton soil, the limitations are greater than in the moderately eroded areas. The severely eroded spots should be kept in hay or pasture, or where practical, they can be planted to trees. (Capability unit IVe-4, woodland suitability group 3)

Hixton fine sandy loam, 12 to 20 percent slopes, moderately eroded (HmD2).—This soil has a profile similar to the one described for the series. The hazard of further erosion is severe.

Included in mapped areas of this soil is a small acreage in which erosion has already been severe. Also included are small areas of Hixton fine sandy loam, 12 to 20 percent slopes.

The greater part of the acreage is cultivated, and a large part of the cropping system in those areas consists of hay crops. Because of the severe hazard of further erosion, many areas are used for pasture and are worked only to the extent necessary for reseeding.

This moderately steep soil is suited to hay, pasture, and trees, and it can also be used for providing food and cover for wildlife. If hay crops are grown, the hayfields should be renovated no oftener than once in 5 years. In pastured areas grazing ought to be controlled so that a good cover of plants is left and the sod maintained. (Capability unit VIe-4, woodland suitability group 3)

Hixton fine sandy loam, loamy substratum, 2 to 6 percent slopes (HnB)—This is a gently sloping soil that occurs on upland plains and valley slopes with Boone and other Hixton soils. Its profile is like the one described for the series, except that the substratum is loamy and the texture of the surface layer is generally fine sandy loam. Included in mapped areas of this soil is a rather small acreage in which the texture of the surface layer is loamy fine sand.

Hixton fine sandy loam, loamy substratum, 2 to 6 percent slopes, has lost only a small amount of soil material through erosion. The amount of runoff is rather small, but this soil is slightly susceptible to water erosion. In addition, wind erosion is a slight hazard, and this soil is droughty. The surface layer has a rather high content of organic matter. Natural fertility and the available moisture capacity are slightly higher than those of the steeper Hixton soils.

This soil is suited to all of the locally grown crops. Fairly simple management practices are required to maintain good tilth. Practices that conserve moisture, that maintain the supply of organic matter and the fertility, and that control wind erosion are beneficial. Where irrigation is feasible, it can be used to advantage. (Capability unit IIe-7, woodland suitability group 3)

Hixton fine sandy loam, loamy substratum, 2 to 6 percent slopes, moderately eroded (HnB2).—This soil is mainly on valley slopes that border sandstone buttes. It is susceptible to further damage caused by water erosion, and it is somewhat droughty. The profile is deeper over the underlying material than the profile described for the series, and the surface layer is thicker. Also, the substratum is loamy.

If this soil is carefully managed, it is suited to row crops, small grains, and hay. Nearly all of the acreage is used for crops. Control of erosion is needed to maintain the present depth of the soil material and the moisture-supplying capacity. Management practices that help to supply organic matter are also highly beneficial. Generally, lime and fertilizer are needed. During seasons of little rainfall or of poorly distributed rainfall, crop yields are likely to be reduced by lack of moisture. (Capability unit IIe-7, woodland suitability group 3)

Hixton fine sandy loam, loamy substratum, 6 to 12 percent slopes (HnC).—This soil has a profile similar to the one described for the series. The surface layer is slightly thinner and darker colored, however, and the texture is fine sandy loam instead of loam. Also, the substratum is loamy.

Nearly all areas of this soil are wooded, and a thin layer of leaf litter covers the surface in the wooded areas. Organic matter from the decaying leaves has been incorporated in the immediate surface layer and has added a darker color to the soil material. (Capability unit IIIe-7, woodland suitability group 3)

Hixton fine sandy loam, loamy substratum, 6 to 12 percent slopes, moderately eroded (HnC2).—This soil has lost from one-third to two-thirds of its original surface layer through erosion. Included with it in mapping is a small acreage in which erosion has been severe.

Hixton fine sandy loam, loamy substratum, 6 to 12 percent slopes, moderately eroded, is not suited to intensive use for tilled crops. Most of the acreage is cultivated, however, and fair yields of small grains and hay are obtained if management is good. If row crops are grown, special practices are needed to control further erosion. Natural fertility is moderately low.

Crops grown on this soil need lime and fertilizer, and a cropping system should be used in which the crops supply organic matter. This soil holds more moisture for the use of plants than Hixton soils that lack a loamy substratum. Crops grown on it are less susceptible to damage from drought than are crops grown on the Hixton soils that have a loamy substratum. In the small included acreage, where erosion has been severe, limitations to use are greater than in other places. In those areas large amounts of manure and commercial fertilizer are generally needed to establish a satisfactory stand of plants. (Capability unit IIIe-7, woodland suitability group 3)

Hixton fine sandy loam, loamy substratum, 12 to 20 percent slopes (HnD).—This is a moderately steep soil on valley slopes adjacent to sandstone buttes. It occurs in the northwestern part of the county. Its profile is like the one described for the series, except that sandstone is generally nearer the surface, the substratum is loamy, and the surface layer is darker colored and has a texture of fine sandy loam.

This soil generally occurs in areas not suitable for tillage, and it is not cultivated. Many of the areas are in trees, and the surface in those areas is covered by leaf litter. Organic matter from the leaf litter is incorporated in the surface layer. As a result, the surface layer has a darker color than that of a cultivated soil.

This soil is suitable for forage crops grown for hay or pasture. It can also be used as woodland or to provide food and cover for wildlife. The hazard of water erosion is severe, however, and this soil is subject to gullying if it is not protected. This soil holds more moisture than the Hixton soils that lack a loamy substratum. Crops grown on it are less susceptible to drought during periods when the amount of rainfall is low, or when rainfall is poorly distributed, than crops grown on Hixton soils underlain by sand. (Capability unit IVe-7, woodland suitability group 3)

Hixton fine sandy loam, loamy substratum, 12 to 20 percent slopes, moderately eroded (HnD2).—This soil is in areas similar to those occupied by Hixton fine sandy loam, loamy substratum, 12 to 20 percent slopes. It is more accessible, however, and it has been cultivated. As a result, water erosion has removed from one-third to two-thirds of the original surface layer. The present surface layer is lighter colored than the original one, and the profile is generally shallower over sandstone than the profile described for the series. Also, the substratum is loamy instead of sandy.

This soil is more droughty than Hixton fine sandy loam, loamy substratum, 12 to 20 percent slopes. Nevertheless, most limitations are similar and management of the two soils is about the same. (Capability unit IVe-7, woodland suitability group 3)

Hixton fine sandy loam, loamy substratum, 20 to 30 percent slopes (HnE).—This is a steep soil that has been used for trees or pasture and is not eroded. Its surface layer and subsoil are darker colored and thinner than the ones in the profile described for the series, and bedrock is considerably nearer the surface. Wooded areas of this soil have a leaf-covered surface, and the leaves absorb water and reduce runoff.

Included in mapped areas of this soil are small areas of Hixton fine sandy loam that lacks a loamy substratum, and small areas of Hesch fine sandy loam. Also included is a small acreage in which the slopes are steeper than 30 percent.

Hixton fine sandy loam, loamy substratum, 20 to 30 percent slopes, is too steep for tilled crops, but it can be used for hay, pasture, trees, or wildlife areas. If it is used for pasture or hay crops, renovation and topdressing with fertilizer will improve yields. The sod can be maintained by controlling grazing so that a good cover of plants remains. (Capability unit VIe-7, woodland suitability group 3)

Hixton loam, loamy substratum, 2 to 6 percent slopes (HtB).—This is a gently sloping soil of upland plains and valley slopes. It has a profile like the one described

for the series, except that the substratum is loamy and the surface layer is thicker and darker colored.

Included in mapped areas of this soil are small areas of Hixton loam, loamy substratum, 2 to 6 percent slopes, moderately eroded. Also included, in broad drainageways, is a rather small acreage of a nearly level Hixton loam that has a loamy substratum.

Runoff is rather slow, but erosion is a slight hazard. Only simple practices are needed, however, to protect this soil. In the surface layer, the content of organic matter is rather high. This soil is generally deeper than the more sloping Hixton soils. Also, it has higher natural fertility and higher available moisture capacity.

This soil is suited to all of the locally grown crops. It is slightly droughty in addition to being slightly susceptible to erosion. Good tilth can be maintained by using simple management practices. (Capability unit IIe–1, woodland suitability group 1)

Hixton loam, loamy substratum, 6 to 12 percent slopes, moderately eroded (HtC2).—The profile of this soil is slightly thinner and contains a lighter colored surface layer than the profile described for the series, and the substratum is loamy. From one-third to two-thirds of the original surface layer has been lost through erosion. Because of loss of organic matter and mixing of the surface soil and subsoil by tillage, the present surface layer is in poorer tilth than the original one. Also, natural fertility is lower, and the rate of infiltration is slower. Practically all of the acreage is cultivated.

Included in mapped areas of this soil are small areas of Hixton loam, loamy substratum, 6 to 12 percent slopes, that are not eroded or that are only slightly eroded. Also included are a few acres in which erosion has been severe.

In some of the severely eroded spots, the surface layer is very thin. In others, all of the original surface layer has been removed and the subsoil is exposed. Careful management is needed to control further erosion in these severely eroded areas. (Capability unit IIIe–1, woodland suitability group 1)

Hixton loam, loamy substratum, 12 to 20 percent slopes, eroded (HtD2).—The profile of this moderately steep soil is generally shallower over sandstone than the one described for the series. Also, erosion has made the present surface layer light colored and low in content of organic matter, and the substratum is loamy instead of sandy. In many places where this soil is on valley slopes, it has fragments of sandstone on the surface and throughout the profile.

Included in mapped areas of this soil are small areas of Hixton loam, loamy substratum, 12 to 20 percent slopes. Also included is a small acreage in which erosion has been severe.

Hixton loam, loamy substratum, 12 to 20 percent slopes, eroded, is used mainly for crops. Where this soil is cultivated, practices are needed that control erosion. Keeping tillage to a minimum is beneficial, as well as using a cropping system in which hay crops are grown a large part of the time. In the severely eroded spots, soil limitations are greater than in other areas. In those areas especially careful management is needed to help to control erosion. (Capability unit IVe–1, woodland suitability group 1)

Lamont Series

The Lamont series consists of deep soils that are well drained. These soils are nearly level to moderately steep. They formed on outwash plains in windblown material that has a texture of very fine sand.

Representative profile of Lamont very fine sandy loam:

0 to 12 inches, very dark grayish-brown, friable very fine sandy loam.
12 to 31 inches, dark-brown, friable very fine sandy loam.
31 to 36 inches, dark-brown, very friable loamy very fine sand.
36 to 41 inches, dark reddish-brown, firm loam.
41 to 48 inches +, brown, very friable loamy very fine sand.

The Lamont soils have moderately rapid permeability and moderately low available moisture capacity. They are medium acid to strongly acid. In places the profile contains a slightly cemented layer. However, this layer is generally below the depth of root penetration of all but the deep-rooted plants. Natural fertility is moderately low.

Lamont very fine sandy loam, 2 to 6 percent slopes, moderately eroded (LaB2).—This is a gently sloping soil on river terraces and outwash plains above the St. Croix River. It occurs with Chetek, Meridian, and Rockton soils, and small areas of those soils are included with it in mapping. Also included are a few acres of a slightly eroded Lamont very fine sandy loam.

The hazards of wind and water erosion are slight, but careful management is required to control erosion. Drought is also a slight hazard.

If this soil is properly managed, it is suited to all the locally grown crops. Contour stripcropping is the preferred management practice, because it not only protects against erosion but also conserves moisture. Where contour stripcropping is used, row crops can be grown 2 years in 5. (Capability unit IIe–7, woodland suitability group 3)

Lamont very fine sandy loam, 6 to 12 percent slopes, moderately eroded (LaC2).—This is a sloping soil that occurs in the same general areas as Lamont very fine sandy loam, 2 to 6 percent slopes, moderately eroded. It has the profile described for the series. From one-third to two-thirds of its original surface layer has been lost through erosion.

Included in mapped areas of this soil is a small acreage of a soil that has a similar profile but that is not eroded or is only slightly eroded. Most of the acreage of this included soil is in trees.

Lamont very fine sandy loam, 6 to 12 percent slopes, moderately eroded, is susceptible to further erosion. The hazard of wind erosion is slight, and the hazard of water erosion is moderate. In addition, this soil is slightly droughty. If tilled crops are grown, special practices are needed that control erosion. Where contour stripcropping is practiced, row crops can be grown 1 year out of 4. (Capability unit IIIe–7, woodland suitability group 3)

Lamont very fine sandy loam, 12 to 20 percent slopes, moderately eroded (LaD2).—This is a moderately steep soil on outwash plains above the St. Croix River. It is on long, narrow slopes bordering the drainageways that extend into the plain from the bank of the river. The surface layer is lighter colored than the one in the profile described for the series. Because this soil has been used

for crops, it has lost from one-third to two-thirds of its original surface layer through erosion.

Included in mapped areas of this soil are a few acres in which erosion has been slight. Most of these slightly eroded spots are wooded. The profile in the included areas is similar to the profile described for the series, except that the surface layer has a darker color.

Lamont very fine sandy loam, 12 to 20 percent slopes, moderately eroded, is susceptible to severe water erosion, and it is moderately droughty. It is subject to gullying if it is not protected. This soil is suited to meadow crops, pasture, and trees, and it can also be used for providing food and cover for wildlife. In the areas used for pasture, grazing should be controlled to maintain the sod. (Capability unit IVe–7, woodland suitability group 3)

Lawler Series

The Lawler series consists of soils that are moderately deep, mainly nearly level, and somewhat poorly drained. These soils are on terraces of the Trimbelle River and of the South Fork of the Kinnickinnic River. They have formed in loamy material. In many places the substratum is sandy, but in some it is loamy.

Representative profile of Lawler loam:

0 to 16 inches, black, friable loam; very dark grayish brown in the lower part; many, pink, pale-brown, and grayish-brown mottles.
16 to 28 inches, brown, firm clay loam mottled with gray, dark brown, and yellowish red.
28 to 36 inches, grayish-brown, friable loam mottled with dark brown and light brownish gray.
36 to 50 inches +, bands of yellowish-brown and pale-brown, loose sand.

The Lawler soils have moderately slow permeability, slow internal drainage, and high available moisture capacity. In areas that have not been limed, these soils are slightly acid to strongly acid. The surface layer has a neutral reaction in areas that have been limed. The reaction of the underlying material is neutral or mildly alkaline. Roots can penetrate to the underlying sand at a depth of about 30 inches. Natural fertility is moderately high.

Most areas of these soils are used for crops. These soils are not important for farming, however, because they are limited by somewhat poor drainage.

Lawler loam, 0 to 3 percent slopes (LcA).—This soil has the profile described for the series. It is on low stream terraces. In most places it is at the base of slopes and receives runoff from the slopes above. The somewhat poor drainage is the result mainly of a water table above a very slowly permeable layer at a depth below 60 inches.

In spring, fieldwork may be delayed because this soil is too wet for tillage. The nearly level areas that are not adequately drained are subject to ponding during wet seasons. The ponded water can be removed by installing open ditches.

If this soil is adequately drained, it is suited to moderately intensive use. The undrained areas are suited to limited use for growing hay crops and small grains. They can also be used for pasture. (Capability unit IIw–5, woodland suitability group 12)

Lawler silt loam, 0 to 2 percent slopes (LwA).—The profile of this soil is like the one described for the series, except that the texture of the surface layer is silt loam. This soil is on low stream terraces. The somewhat poor drainage is caused mainly by a water table above a very slowly permeable layer at a depth below 60 inches.

In spring, fieldwork may be delayed because this soil is too wet for tillage. The nearly level areas that are not adequately drained are subject to ponding during wet seasons. The ponded water can be removed by installing open ditches. Maintaining the banks of the ditches is difficult because of the coarse texture of the material in the substratum.

If this soil is adequately drained, it is suited to moderately intensive use. The undrained areas are suited to limited use for growing hay crops and small grains, or they can be used for pasture. (Capability unit IIw–5, woodland suitability group 12)

Lawler silt loam, 2 to 6 percent slopes (LwB).—This is a gently sloping soil on low stream terraces. In most places it has slopes no steeper than 4 percent. This soil is mainly at the base of slopes and receives water that has concentrated and that has run off the slopes above. Water erosion is a slight hazard, but in other respects management and use of this soil are similar to those of Lawler silt loam, 0 to 2 percent slopes. Suitable practices for controlling the runoff from the slopes above are helpful in relieving wetness and in controlling erosion. (Capability unit IIw–5, woodland suitability group 12)

Meridian Series

The Meridian series consists of well-drained soils on terraces of the major streams in the county. These soils are nearly level to sloping. They have formed in 20 to 40 inches of loamy material over stratified outwash sand.

Representative profile of Meridian loam:

0 to 10 inches, very dark grayish-brown, friable loam.
10 to 24 inches, dark-brown, firm loam.
24 to 28 inches, dark-brown, friable loam.
28 to 40 inches +, yellowish-brown, loose sand.

The Meridian soils have moderate permeability and medium available moisture capacity. They are slightly acid to strongly acid. The root zone for most crops extends to the sandy substratum, but large roots penetrate deeper. Natural fertility is moderate.

Meridian loam, 0 to 2 percent slopes (MdA).—This is a nearly level soil on broad stream terraces. Its profile is similar to the profile described for the series, except that it is deeper over the underlying sand.

This soil is slightly droughty, but there is little danger of erosion. Using practices that conserve moisture helps to maintain high yields.

This soil can be used intensively for cultivated crops if favorable soil structure is maintained. Row crops can be grown year after year if all crop residue is returned to the soil, if a good supply of plant nutrients and good tilth are maintained, and if minimum tillage is practiced. Where this soil occurs in the broad valleys in the northwestern part of the county, the areas underlain by finer textured material have higher available moisture capacity than typical. (Capability unit IIs–1, woodland suitability group 1)

Meridian loam, 2 to 6 percent slopes (MdB).—This is a gently sloping soil on stream terraces. It has a profile like

the one described for the series, except that in some places the substratum is loamy. Included in mapped areas of this soil is a small acreage of Meridian loam, 6 to 12 percent slopes, moderately eroded.

If cultivated crops are grown, erosion is a slight hazard. Also, this soil is slightly susceptible to drought.

If this soil is well managed, it is suited to all the crops grown in the county. During dry years, or when rainfall is poorly distributed throughout the growing season, crops may be damaged by lack of moisture. The areas in which the substratum is loamy are less droughty than those in which the substratum is sandy. The crops grown on this soil are similar to those grown on Meridian loam, 0 to 2 percent slopes. Limitations are also similar, except that this soil is more susceptible to erosion. (Capability unit IIe-2, woodland suitability group 1)

Onamia Series

The Onamia series consists of well-drained soils that are moderately deep and that are nearly level to moderately steep. These soils have formed in medium-textured material over sandy and gravelly outwash. They are on stream terraces and outwash plains, mainly in the northwestern part of the county and along the Kinnickinnic River to River Falls. Smaller areas, in which these soils are nearly level or gently sloping, occupy terraces along other major streams. In the extreme northwestern corner of the county, these soils occur in an area where the topography is complex.

Representative profile of a cultivated Onamia loam:

0 to 15 inches, very dark grayish-brown, friable loam.
15 to 26 inches, dark-brown, firm heavy loam.
26 to 30 inches, dark-brown, firm sandy clay loam.
30 to 33 inches, dark-brown, friable sandy loam.
33 to 48 inches +, dark-brown, loose gravelly sand.

Onamia soils are moderately permeable and have medium internal drainage. Onamia loams have moderate available moisture capacity and Onamia sandy loams have moderately low available moisture capacity. These soils are slightly acid to strongly acid and have moderate natural fertility. In general, the root zone extends to a depth of 22 to 42 inches. Large roots can penetrate, however, to a depth greater than 42 inches.

Locally, these soils are important for farming. Yields are generally high if management is good, and if rainfall is favorably distributed. Where these soils occur in the areas of complex topography in the northwestern part of the county, contour stripcropping and other needed practices that help to control erosion and that conserve moisture are difficult to apply.

Onamia loam, 0 to 2 percent slopes (OmA).—This soil has a profile similar to the one described for the series. It is on stream terraces. Because of the small amount of runoff and moderate permeability, there has been little or no erosion and the risk of future erosion is slight. The surface layer is 9 to 15 inches thick.

This nearly level soil is suited to all of the crops commonly grown in the county. Row crops can be grown year after year if water is provided through irrigation, and if management is good. Management practices that conserve water are suggested. (Capability unit IIs-1, woodland suitability group 1)

Onamia loam, 2 to 6 percent slopes (OmB).—This is a gently sloping soil that has been subject to little or no erosion. Its profile is similar to the one described for the series. Runoff is more rapid than on Onamia loam, 0 to 2 percent slopes, and this soil is slightly more droughty because less water infiltrates. Erosion is a slight hazard.

This soil is well suited to all the locally grown crops, and yields are moderately high in most years. Practices that control erosion and that conserve water are suggested for sustained high yields. If contour stripcropping is practiced, row crops can be grown 2 years out of 5. (Capability unit IIe-2, woodland suitability group 1)

Onamia loam, 2 to 6 percent slopes, moderately eroded (OmB2).—This soil has lost from one-third to two-thirds of its original surface layer through erosion. The present surface layer is thinner and lighter colored than the original one. In tilled fields the dark-brown subsoil is exposed in some spots. The content of organic matter is lower than in the original surface layer, and natural fertility is lower. Also, the present surface layer is in poorer tilth and the rate of infiltration is lower. Small areas of Onamia sandy loam, 2 to 6 percent slopes, moderately eroded, are included in mapped areas of this soil.

All of the locally grown crops can be grown on Onamia loam, 2 to 6 percent slopes, moderately eroded. Yields are generally lower, however, than on the less eroded Onamia soils. Further erosion can be controlled and water can be conserved by practicing contour stripcropping or by applying other suitable practices. All of the acreage is used for crops. (Capability unit IIe-2, woodland suitability group 1)

Onamia loam, 6 to 12 percent slopes, moderately eroded (OmC2).—This soil has lost part of its original surface layer through erosion, and the present surface layer is 6 to 10 inches thick. The profile is shallower over the coarse-textured substratum than the profile described for the series. The slopes are mainly complex. Included in mapped areas of this soil are small areas of Onamia loam, 6 to 12 percent slopes.

Practices that control erosion and that conserve water are suggested for Onamia loam, 6 to 12 percent slopes, moderately eroded. Where such practices are difficult to apply, a cropping system consisting of a small grain and hay can be used, or this soil can be kept in permanent meadow. (Capability unit IIIe-2, woodland suitability group 1)

Onamia loam, 12 to 20 percent slopes, moderately eroded (OmD2).—This soil is mainly on the complex slopes of a dissected outwash plain. In most places its profile is shallower over the substratum than the profile described for the series. Also, the surface layer is thinner because part of the surface soil has been lost through erosion.

Because this soil is moderately steep, eroded, and droughty, it is not suited to row crops. It can be used for grass, however, or planted to trees. The complex topography makes the operation of equipment difficult and hazardous. (Capability unit IVe-2, woodland suitability group 1)

Onamia sandy loam, 2 to 6 percent slopes (OnB).—This is a gently sloping soil on stream terraces and outwash

plains. It generally occupies single slopes on the terraces, but it also occurs in areas that are complex and hummocky on the outwash plains. The profile is similar to the profile described for the series, except that it has a texture of sandy loam instead of loam. Normally, the surface layer is also thinner, or about 6 to 12 inches thick.

Where this soil occurs with steeper soils, as on the dissected outwash plain in the northwestern corner of the county, it is in permanent pasture. Most of the acreage, however, is used for field crops. Erosion by water and wind is a slight hazard. If this soil is properly managed so that the hazards of droughtiness and erosion are overcome, it is suited to all of the locally grown crops. (Capability unit IIIe-4, woodland suitability group 3)

Onamia sandy loam, 6 to 12 percent slopes, moderately eroded (OnC2).—This is a sloping soil that in most places has lost from one-third to two-thirds of its original surface layer through erosion. In some spots all of the original surface layer has been removed and the dark-brown subsoil is exposed. The remaining surface soil is low in content of organic matter and is in poorer tilth than the surface layer in areas that are not eroded. Also, the profile is shallower over the coarse-textured substratum than the profiles of the less sloping Onamia soils. The profile is similar to the profile described for the series, but the surface layer is thinner. Also, the texture is sandy loam instead of loam throughout the profile. Included in mapped areas of this soil are small areas of Chetek sandy loam.

Further erosion is a moderate hazard. Also, drought is a slight hazard.

Onamia sandy loam, 6 to 12 percent slopes, moderately eroded, is not suited to row crops unless practices are used to control erosion and to conserve moisture. If contour stripcropping is practiced, a cropping system of 1 year of a row crop, 1 year of a small grain, and 3 years of meadow adequately controls erosion and conserves water. (Capability unit IVe-4, woodland suitability group 3)

Orion Series

The Orion series is made up of deep soils that are somewhat poorly drained. These soils have formed in layered silty sediments washed down from loess-covered uplands and terraces. They occupy scattered areas on flood plains of the larger streams in the county and on narrow bottoms along the smaller streams. The profile commonly contains a dark-colored, buried surface layer at a depth greater than 18 inches. Mottling generally occurs throughout the profile.

Representative profile of Orion silt loam:

0 to 28 inches, very dark grayish-brown, friable silt loam; many dark-brown mottles.
28 to 40 inches, dark-brown, friable silt loam; dark-brown mottles.
40 inches +, dark grayish-brown, friable silt loam; dark-brown mottles.

These Orion soils have slow internal drainage, caused mainly by the water table near the surface. In most places the water table is at a depth of less than 5 feet. Permeability is moderate, and surface runoff is slow because of the gentle slopes. These soils have high available moisture capacity, and they contain no layers that would limit the penetration of roots. Nevertheless, they are susceptible to damage from overflow and deposition. Their reaction is neutral or slightly acid.

In Pierce County the Orion soils are not important for farming. Moderately high yields can be obtained, however, if these soils are well managed.

Orion silt loam (0 to 3 percent slopes) (Or).—This soil is on low bottoms and flood plains. It is the only soil of the Orion series mapped in Pierce County.

The nearly level relief and thick, friable surface layer make this soil easy to till. Flooding is the major hazard. This soil is also susceptible to streambank erosion, and it receives deposits of undesirable material when it is flooded. Flooding is a greater hazard on the lower, nearly level areas bordering the stream channel than in other places. Most of the gently sloping areas are better protected from flooding and have better surface drainage than the nearly level spots.

This soil can be cropped intensively if it is protected from overflow during the cropping season, and if other good management practices are used. Diversions can be used to intercept runoff from the adjoining slopes. In most places drainage is needed for dependable yields. (Capability unit IIw-13, woodland suitability group 9).

Ostrander Series

The Ostrander series consists of soils that are well drained. These soils have formed in 12 to 30 inches of silty material over glacial till. They are nearly level to sloping.

Representative profile of a cultivated Ostrander silt loam:

0 to 16 inches, very dark gray, friable silt loam.
16 to 20 inches, dark-brown, friable silty clay loam.
20 to 30 inches, dark yellowish-brown, firm heavy loam.
30 inches +, strong-brown, very firm clay loam.

The Ostrander soils have moderate to moderately slow permeability and medium internal drainage. Their available moisture capacity is moderately high, and reaction is medium acid to neutral. These soils have moderately high natural fertility, and they do not contain a layer that restricts the penetration of roots. They are well suited to all the locally grown crops. Response is good to applications of fertilizer.

Ostrander silt loam, 0 to 2 percent slopes (OsA).—Although this soil is nearly level, it occurs in areas bordering drainageways where the topography is mainly rolling. It is lower than the surrounding areas, and it receives runoff from the adjacent slopes. The surface layer, in most places, is thicker than the one in the profile described for the series. Also, the profile is deeper over the layer of till, because this soil receives deposits of silty material from the adjoining slopes. Because of the nearly level relief and the rather rapid rate of infiltration, surface runoff is very slow. There is no hazard of erosion.

This is one of the most desirable soils for farming in the county. All of the acreage is used for crops. Row crops can be grown year after year if an adequate supply of plant nutrients and the content of organic matter are

maintained. (Capability unit I–1, woodland suitability group 12)

Ostrander silt loam, 2 to 6 percent slopes (OsB).—This soil has the profile described for the series. Its slopes are between 2 and 4 percent in most places. Although the slopes are mild, water erosion is a slight hazard and practices are needed to protect the soils. Practically all of the acreage is used for crops.

Runoff is rather slow, and only simple practices are needed to control erosion. Row crops can be grown 2 years out of 5 if stripcropping is practiced. A more intensive cropping system may be used if the fields are terraced. (Capability unit IIe–1, woodland suitability group 12)

Ostrander silt loam, 2 to 6 percent slopes, moderately eroded (OsB2).—This soil has lost from one-third to two-thirds of its original surface layer through erosion. The present surface layer is thinner (8 to 10 inches thick) than the one in the profile described for the series, and it is brown instead of very dark gray. In most places the slopes are between 3 and 6 percent.

Practically all areas of this soil are cultivated. In the areas that are cultivated, this soil contains less organic matter, is in poorer tilth, and is more susceptible to erosion than in areas that have not been disturbed. Rather simple practices that help to control erosion and that conserve water are needed to maintain good tilth. (Capability unit IIe–1, woodland suitability group 12)

Ostrander silt loam, 6 to 12 percent slopes, moderately eroded (OsC2).—This soil is on the uplands. Its surface layer is thinner and lighter colored than the one in the profile described for the series, and the profile is shallower over the layer of till. In most places as much as two-thirds of the original surface layer has been lost through erosion and the present surface layer is 6 to 9 inches thick. The dark-brown subsoil is exposed, however, in some spots.

This soil has lost part of its content of organic matter and is in poorer tilth than before it was eroded. As a result, the present surface layer is more suceptible to erosion than the original one. The hazard of further erosion is moderate.

Row crops can be grown on this sloping soil if practices are used to control erosion. All of the acreage has been cultivated. (Capability unit IIIe–1, woodland suitability group 12)

Otterholt Series

The Otterholt series consists of deep, well-drained, silty soils that range from nearly level to moderately steep. These soils have formed on uplands in a mantle of loess over glacial till. They are mainly in the eastern part of the county, but they occur, to a lesser extent, west of the Rush River.

Representative profile of an Otterholt silt loam that has not been cultivated:

0 to 15 inches, dark grayish-brown, friable silt loam.
15 to 43 inches, dark-brown, friable silt loam.
43 to 53 inches, dark-brown, plastic clay loam till.
53 to 67 inches +, grayish-brown, plastic clay loam till.

The Otterholt soils have moderate permeability and moderately high available moisture capacity. They do not contain a layer that limits the penetration of roots. Reaction is slightly acid to very strongly acid. Natural fertility is high, but good response is received from applications of fertilizer.

These soils are desirable for farming and are suited to all of the crops commonly grown in this area. Lime is needed for good yields of crops.

Otterholt silt loam, 2 to 6 percent slopes (OtB).—This soil is on the broad, rounded tops of ridges. It has a profile like the one described for the series.

Areas of this soil that have been cleared, or that it is feasible to clear, are well suited to row crops, small grains, and hay. If cultivated crops are grown, erosion is a slight hazard, but it can be easily controlled. This soil can be cropped intensively if it is protected from erosion, and if adequate lime and fertilizer are applied. Row crops can be grown 2 years out of 5 if practices are used that control erosion. (Capability unit IIe–1, woodland suitability group 1)

Otterholt silt loam, 2 to 6 percent slopes, moderately eroded (OtB2).—This soil occupies fairly large areas on the central parts of broad, rounded ridgetops. It is in the eastern half of the county. From 4 to 8 inches of the original surface layer has been lost through erosion. The present surface layer is thinner and lighter colored than the original one, and it contains less friable material brought up from the subsoil by tillage.

This soil is well suited to row crops, small grains, and hay, and nearly all of the acreage is cultivated. If a suitable cropping system is used, and if needed erosion control practices are applied, cropping can be fairly intensive. Crop yields are generally good if the supply of plant nutrients is kept high. Supplemental applications of nitrogen are needed for optimum yields of corn. (Capability unit IIe–1, woodland suitability group 1)

Otterholt silt loam, 6 to 12 percent slopes (OtC).—This soil has a profile similar to the one described for the series. Erosion is a moderate hazard.

This soil is suited to row crops, small grains, and hay if erosion has been adequately controlled. Most of the acreage is cultivated. If field crops are grown, lime is generally needed, as well as a complete fertilizer. Where this soil is wooded or used for pasture, yields of timber or of forage crops are generally rather high. (Capability unit IIIe–1, woodland suitability group 1)

Otterholt silt loam, 6 to 12 percent slopes, moderately eroded (OtC2).—The surface layer of this soil is grayish brown, or lighter colored than the one in the profile described for the series. From 4 to 8 inches of the original friable surface layer has been lost through erosion. Tillage implements have mixed less friable material from the subsoil with the remaining surface soil. The hazard of further erosion is moderate.

Most of the acreage is used for cultivated crops. This soil is well suited to row crops, small grains, and hay if practices are used to control further erosion. Generally, erosion control practices are fairly easy to apply, and they should be applied with fair intensity. If a suitable cropping system is used, and if an adequate supply of plant nutrients is maintained, good yields are normally obtained. The crops respond well if a complete fertilizer and manure are added. Lime is generally needed. (Capability unit IIIe–1, woodland suitability group 1)

Otterholt silt loam, 6 to 12 percent slopes, severely eroded (OtC3).—This soil has lost more than two-thirds of its original surface layer through erosion. In much of the acreage that is now cultivated, the subsoil is exposed. The present surface layer is dark brown. It is low in content of organic matter and is difficult to keep in good tilth. The rate of water infiltration is slower, than in the uneroded Otterholt silt loam, 6 to 12 percent slopes. Also, more water runs off this soil and further erosion is a greater hazard. Yields of row crops are low.

The productive capacity of this soil has been lowered by erosion, but it can be increased by good management. Large applications of manure will build up the content of organic matter. Liming and applying fertilizer according to the needs indicated by the results of soil tests will restore part of the fertility. Row crops should not be grown, unless contour stripcropping or a similar practice is used to control erosion. (Capability unit IVe–1, woodland suitability group 1)

Otterholt silt loam, 12 to 20 percent slopes, moderately eroded (OtD2).—This soil has lost from one-third to two-thirds of its original surface layer through erosion. The present surface layer is lighter colored than the one in the profile described for the series. Material from the subsoil has been mixed with the surface soil by tillage. This soil occurs in slightly lower areas than those occupied by less sloping Otterholt soils on the ridgetops. It receives runoff from the higher lying soils. Included with it in mapping are small areas of Otterholt silt loam, 12 to 20 percent slopes.

If cultivated crops are grown, Otterholt silt loam, 12 to 20 percent slopes, moderately eroded, is highly susceptible to damage from further erosion. Hay can be grown, or a cropping system can be used in which row crops are grown less frequently than hay or pasture crops. (Capability unit IVe–1, woodland suitability group 1)

Plainfield Series

The Plainfield series is composed of deep, sandy soils that are excessively drained. These soils have formed in coarse-textured, water-laid material from sandstone, or from well-sorted glacial outwash. They are on stream terraces along the Mississippi and St. Croix Rivers. They also occur on the outwash plain near River Falls.

Representative profile of Plainfield loamy sand in a woodlot:

0 to 15 inches, dark-brown, very friable loamy sand.
15 to 25 inches, dark yellowish-brown, loose sand.
25 to 60 inches +, yellowish-brown, loose sand, with bands of dark yellowish-brown material throughout.

The Plainfield soils have very rapid permeability, very low available moisture capacity, and very rapid internal drainage. Consequently, they are droughty. Good management and good distribution of rainfall during the growing season are necessary for even fair yields. Because of the lack of fine-textured binding material in the surface layer, these soils are susceptible to erosion by wind and water. They are low in natural fertility and are neutral to slightly acid in reaction. The root zone is not restricted.

Plainfield loamy sand, 0 to 2 percent slopes (PmA).—The largest areas of this soil are along the Mississippi River on the terrace between Bay City and Hager City. Smaller areas occur as far upstream as Prescott and occupy other stream terraces in the county. Because of the very rapid permeability and nearly level relief, the hazard of water erosion is slight.

Most of the acreage is cultivated, but some areas are in slow-growing hardwood trees. If the cropping system is suitable, and if good management is used, this soil is suited to row crops, small grains, and hay. This soil is droughty. Therefore, crops that mature early or that are deep rooted should be grown. The supply of plant nutrients and the content of organic matter are low. This soil is easily eroded by wind. Such special practices as stripcropping or use of shelterbelts are needed to prevent blowing. (Capability unit IVs–3, woodland suitability group 4)

Plainfield loamy sand, 2 to 6 percent slopes (PmB).—This is a gently sloping or gently undulating soil. It has a profile like the one described for the series. In some places as much as one-third of the original surface layer has been lost through erosion caused by water and wind. Included in the areas mapped are small areas of Lamont loamy very fine sand.

Plainfield loamy sand, 2 to 6 percent slopes, is low in plant nutrients and in content of organic matter. It is suited to most of the crops commonly grown in the county, however, if practices are used that control erosion. Much of the acreage is used for cultivated crops, but a rather large acreage is in grass or trees. (Capability unit IVs–3, woodland suitability group 4)

Plainfield loamy sand, 2 to 6 percent slopes, eroded (PmB2).—This is a gently sloping soil that has lost from one-third to two-thirds of its original surface layer through erosion by wind and water. Included in the areas mapped are small areas of Lamont loamy very fine sand.

Plainfield loamy sand, 2 to 6 percent slopes, eroded, is droughty, low in plant nutrients, and easily eroded, but it is suitable for cultivation. Most of the acreage is cultivated, although conifers have been planted in some areas. If good management is used, fair crop yields can be obtained in years of favorable rainfall. The yields are low and crops may fail during seasons when little rainfall is received, or when the rainfall is poorly distributed. (Capability unit IVs–3, woodland suitability group 4)

Plainfield loamy sand, 6 to 12 percent slopes (PmC).—In some places this sloping soil has never been cleared. In others it has been cultivated but has lost no more than one-third of the original surface layer through erosion. The profile is similar to the profile described for the series. Small areas of Lamont loamy very fine sand are included in the mapped areas of this soil.

Most of the acreage is in trees, brush, or idle cropland. Only a small acreage is cultivated. The low available moisture capacity and severe hazards of wind erosion and water erosion make this soil unsuitable for cultivated crops grown year after year. Forage crops can be grown for hay or pasture, or pines can be planted. Renovating the hayfields or pastures and seeding them to forage crops will help to control erosion and to conserve moisture. (Capability unit VIs–3, woodland suitability group 4)

Plainfield loamy sand, 6 to 12 percent slopes, eroded (PmC2).—This is a sloping soil that has lost from one-third to two-thirds of its original surface layer through wind and water erosion. Most of the acreage has been used for crops, but many areas are now planted to pines. Some areas are idle and support a sparse cover of grass or weeds.

Droughtiness, susceptibility to erosion by wind and water, and low fertility are severe limitations if this soil is used for crops. Forage crops can be grown for hay or pasture if careful management is used, but yields are generally low. This soil is also suited to pine trees. (Capability unit VIs-3, woodland suitability group 4)

Port Byron Series

The Port Byron series consists of deep, well-drained soils formed in thick deposits of silty windblown material (loess). These soils are nearly level to sloping. They are on terraces and uplands, mainly in the western part of the county.

Representative profile of Port Byron silt loam:

0 to 16 inches, very dark brown, friable silt loam.
16 to 28 inches, dark-brown, friable silt loam.
28 to 50 inches, dark-brown, friable coarse silt.
50 inches +, fissured dolomite.

The Port Byron soils have moderate permeability and high available moisture capacity. The reaction ranges from neutral to medium acid. The root zone is deep. Natural fertility is high, and the crops that are grown respond well to applications of fertilizer. Locally, these soils are important for agriculture.

Port Byron silt loam, 0 to 2 percent slopes (PoA).—This is a nearly level soil on stream terraces and on plains in the uplands. Its profile is similar to the one described for the series, but it is generally deeper over limestone bedrock. No apparent erosion has taken place, and practices that control erosion are not needed.

Clean-tilled crops can be grown intensively on this soil. Yields are generally high if an adequate supply of plant nutrients and organic matter are maintained. (Capability unit I-1, woodland suitability group 12)

Port Byron silt loam, 2 to 6 percent slopes (PoB).—This soil is on the broad, gentle slopes of upland plains. It has retained nearly all of its original surface layer, and its profile is similar to the one described for the series. The surface layer is in good tilth, has a fairly high content of organic matter, and absorbs water well. Therefore, erosion caused by runoff is not a serious hazard.

Included in mapped areas of this soil is a small acreage of a soil that is moderately eroded. This included soil has a profile similar to the one described for the series, except that the surface layer is lighter colored.

Port Byron silt loam, 2 to 6 percent slopes, is well suited to corn, oats, and hay, and it is used mainly for crops. Sustained good yields are generally obtained if practices are used that control erosion and that maintain the content of organic matter and the supply of plant nutrients. The included moderately eroded soil has about the same limitations as this soil and is managed in the same way. (Capability unit IIe-1, woodland suitability group 12)

Port Byron silt loam, 6 to 12 percent slopes, moderately eroded (PoC2).—This soil has a profile similar to the one described for the series. The surface layer is thinner, however, and is slightly lighter colored. In most places from one-third to two-thirds of the original surface layer has been lost through erosion. A few small areas are severely eroded.

Row crops can be grown less frequently on Port Byron silt loam, 6 to 12 percent slopes, moderately eroded, than on the less sloping Port Byron soils. Careful management is required to control further erosion. If crops are grown, lime is needed and enough fertilizer to maintain the supply of plant nutrients. Crops respond well to applications of a complete fertilizer. The content of organic matter and the supply of nitrogen can be maintained by plowing down a green-manure crop and adding barnyard manure. (Capability unit IIIe-1, woodland suitability group 12)

Racine Series

The Racine series consists of well-drained soils that formed in 12 to 30 inches of windblown silty material (loess) over glacial till. These soils are nearly level to sloping. They occur on uplands, mainly in the western part of the county.

Representative profile of a cultivated Racine silt loam:

0 to 10 inches, very dark grayish-brown, friable silt loam.
10 to 13 inches, dark-brown, friable silt loam.
13 to 26 inches, dark-brown, firm silt loam.
26 to 30 inches +, dark yellowish-brown, firm clay loam.

The Racine soils are moderately permeable and have medium internal drainage. The available moisture capacity is moderately high. Except in areas where lime has been added and the surface layer has a neutral reaction, the soils are medium acid or slightly acid. The profile does not contain a layer that restricts the penetration of roots. Natural fertility is moderately high, but crops grown on these soils respond well to applications of fertilizer.

In this county the Racine soils are not especially important for farming. They are well suited, however, to all of the locally grown crops.

Racine silt loam, 2 to 6 percent slopes (RaB).—This is a gently sloping soil of the uplands. It is not noticeably eroded, and it has a profile like the one described for the series. Included in the areas mapped are small areas of Racine silt loam, 0 to 2 percent slopes.

Racine silt loam, 2 to 6 percent slopes, is productive. It is well suited to crops, and most of the acreage is used for that purpose. Erosion is a slight hazard, although runoff is rather slow. Only simple practices are needed to protect this soil. This soil can be used for row crops 2 years out of 5 if stripcropping is practiced. A more intensive cropping system may be used, however, if more effective practices are used to control erosion. (Capability unit IIe-1, woodland suitability group 1)

Racine silt loam, 2 to 6 percent slopes, moderately eroded (RaB2).—This is a gently sloping soil of the uplands. All of the acreage has been cultivated. From one-third to two-thirds of the original surface layer has been lost through erosion, and the present surface layer is about 6 to 8 inches thick. The present surface layer

generally has a lighter color than the original one, as a result of mixing with the subsoil by tillage. The present surface layer contains less organic matter and is in poorer tilth than the surface layer of a comparable uneroded soil, and the rate of infiltration is slower.

This soil is slightly susceptible to further erosion. The slower rate of infiltration makes erosion a slightly greater hazard than in areas where the rate of infiltration is more rapid. Fairly simple practices that control erosion are needed to maintain good tilth, and these practices should also conserve water. (Capability unit IIe-1, woodland suitability group 1)

Racine silt loam, 6 to 12 percent slopes, moderately eroded (RaC2).—Like the other Racine soils, this soil is on the uplands. All of the acreage has been cultivated. The profile is similar to the one described for the series, but it is shallower over till and has a lighter colored, thinner surface layer. In most places as much as two-thirds of the original surface layer has been lost through erosion. The present surface layer is generally 4 to 7 inches thick, but the dark-brown subsoil is exposed in some spots. The present surface layer has a lower content of organic matter and is in poorer tilth than the original one.

The losses of organic matter and the poorer tilth make the present surface layer more susceptible to erosion than the original one. Further erosion is a moderate hazard. Row crops can be grown, however, if practices are used to control erosion. (Capability unit IIIe-1, woodland suitability group 1)

Renova Series

The Renova series consists of soils that are well drained. These soils have formed in 12 to 30 inches of windblown silty material (loess) over glacial till. They are nearly level to moderately steep. The soils occur on the uplands, mainly in the northern half of the county.

Representative profile of a Renova silt loam that has not been cultivated:

0 to 3 inches, very dark grayish-brown, friable silt loam.
3 to 10 inches, dark grayish-brown, friable silt loam.
10 to 20 inches, dark-brown, friable silt loam.
20 to 46 inches +, dark yellowish-brown, firm clay loam glacial till.

The Renova soils are moderately permeable and have medium internal drainage. They have moderately high available moisture capacity. Reaction is slightly acid to strongly acid. The profile does not contain a layer that restricts the penetration of roots. Natural fertility is moderately high.

These are important soils for crops. They are well suited to all the crops commonly grown in the county, but lime is needed. If the proper amount of lime is added, crops grown on these soils respond well to fertilizer.

Renova silt loam, 0 to 2 percent slopes (ReA).—This soil is most extensive on upland plains in the central and north-central parts of the county. It generally occurs in broad drainageways where soil material from adjoining areas has accumulated. The surface layer is dark colored and is thicker than the surface layer in the more sloping Renova soils. Also, depth to glacial till is normally greater, the silty upper part of the profile is thicker, and the available moisture capacity is higher than in the more sloping soils.

This soil receives runoff from the adjacent slopes. No noticeable erosion has taken place, although all of the acreage has been cultivated. Surface runoff is very slow. Therefore, no special practices are needed to control erosion. The soil can be cropped intensively if the supply of plant nutrients and the content of organic matter are maintained. (Capability unit I-1, woodland suitability group 1)

Renova silt loam, 2 to 6 percent slopes (ReB).—This soil is on broad uplands. It has the profile described for the series.

This gently sloping soil is productive and is desirable for crops. Practically all of the acreage is in permanent pasture, trees, or field crops. In most of the areas used for field crops, the slopes are between 2 and 4 percent. Runoff is rather slow, and the hazard of erosion is slight. Only simple practices are needed to control erosion. Row crops can be grown 2 years out of 5 if stripcropping is practiced. A more intensive cropping system may be used, however, where the fields are terraced. (Capability unit IIe-1, woodland suitability group 1)

Renova silt loam, 2 to 6 percent slopes, moderately eroded (ReB2).—This is a gently sloping soil of the broad uplands. It has been cultivated, and in most places it has lost from one-third to two-thirds of its original surface layer through erosion. In some places, however, all of the original surface layer has been lost and the dark-brown subsoil is exposed. The present surface layer is mainly grayish brown, or lighter colored than the original one. It contains less organic matter and is in poorer tilth than the original surface layer, and the rate of infiltration is slower. In most places the present surface layer is 6 to 8 inches thick.

The slower rate of infiltration slightly increases the susceptibility of this soil to erosion, and further erosion is a slight hazard. Fairly simple practices that control erosion are needed to maintain good tilth, and those practices should also conserve water. (Capability unit IIe-1, woodland suitability group 1)

Renova silt loam, 6 to 12 percent slopes (ReC).—Although this is a sloping upland soil, it has been used primarily as woodland or pasture. As a result, little or no erosion has taken place. In most places the surface layer is about 8 to 10 inches thick. The profile is slightly shallower over glacial till than the one described for the series.

This soil is moderately susceptible to erosion. Row crops can be grown if practices are used to control erosion. Where this soil is stripcropped, row crops can be grown 1 year out of 5. (Capability unit IIIe-1, woodland suitability group 1)

Renova silt loam, 6 to 12 percent slopes, moderately eroded (ReC2).—This sloping soil is on the uplands. It has been cultivated, and in most places it has lost from one-third to two-thirds of its original surface layer through erosion. In some spots, however, all of the original surface layer has been removed and tillage has exposed the subsoil. In those areas the present surface layer is dark brown. The profile is similar to the one described for

the series, except that it is less deep over glacial till and the surface layer is lighter colored and thinner. The present surface layer is generally 4 to 8 inches thick. The surface layer contains less organic matter and is in poorer tilth than the surface layer in areas that are not eroded. Therefore, it is more susceptible to further erosion. The hazard of further erosion is moderate.

This soil can be used for row crops if practices are used to control erosion. If contour stripcropping is practiced, row crops can be grown 1 year out of 5. (Capability unit IIIe-1, woodland suitability group 1)

Renova silt loam, 6 to 12 percent slopes, severely eroded (ReC3).—This soil has lost more than two-thirds of its original surface layer through erosion. Dark-brown material from the subsoil is exposed in much of the acreage that is now cultivated. In the present surface layer, the content of organic matter is low and good tilth is hard to maintain. The rate of water infiltration is slower than in uneroded areas of a comparable soil. Yields are rather low.

The hazard of further erosion is moderate to severe. Large amounts of barnyard manure and commercial fertilizer are needed to return needed organic matter, to build up the supply of plant nutrients, to improve tilth, and to increase the rate of infiltration. Control of erosion is important because this soil is more susceptible to erosion than similar uneroded soils. (Capability unit IVe-1, woodland suitability group 1)

Renova silt loam, 12 to 20 percent slopes (ReD).—Practically all areas of this moderately steep soil are in trees, which have provided protection from erosion. Generally, this soil has formed in a thinner mantle of windblown silt than the Renova soils that have milder slopes. Most of the material below the surface layer consists of glacial till that is finer textured than the silty material. The profile is thinner than the one described for the series, and the surface layer is also thinner. The surface layer is 6 to 10 inches thick.

Wooded areas of this soil are protected by a permanent cover of plants that effectively control erosion. If this soil is used for crops, the hazard of erosion is severe and erosion control practices are needed. Where this soil is used for pasture, control of grazing, so that an adequate cover of plants remains, will help to maintain a firm sod. Cattle should be discouraged from making trails where runoff can concentrate and cause gullying. Wooded areas that are protected from fire and grazing can be managed for sustained production of timber. (Capability unit IVe-1, woodland suitability group 1)

Renova silt loam, 12 to 20 percent slopes, moderately eroded (ReD2).—This moderately steep soil is at a slightly lower elevation than the less sloping Renova and Otterholt soils of the ridgetops, and it receives runoff from those soils. In most places it has lost from one-third to two-thirds of the original surface layer through erosion. In some spots, however, tillage has exposed the subsoil. The present surface layer has a brownish color because dark-brown material from the subsoil has been mixed with it by tillage. The content of organic matter is lower than in the original surface layer.

This soil is suited to hay, but row crops can be grown occasionally if practices are used to control erosion. Where contour stripcropping is practiced, row crops can be grown 1 year out of 5. (Capability unit IVe-1, woodland suitability group 1)

Renova silt loam, 12 to 20 percent slopes, severely eroded (ReD3).—In most places this moderately steep soil has been cultivated and has lost more than two-thirds of its original surface layer through erosion. The present surface layer is dark brown and is less than 4 inches thick. It consists mainly of material that was formerly part of the subsoil, and it is low in content of organic matter and is difficult to till. In some small areas, glacial till is exposed. The rate at which water infiltrates is slow, runoff is rapid, and the hazard of further erosion is very severe. Gullying is difficult to control in the drainageways.

This soil is suited to forage crops grown for hay or pasture, and it can be used in a cropping system that does not include row crops. Large applications of barnyard manure and commercial fertilizer are needed. (Capability unit VIe-1, woodland suitability group 1)

Renova Series, Sandy Variants

Sandy variants of the Renova series are like the soils of the Renova series in many respects, but they differ in some characteristics. These soils are well drained and are gently sloping to moderately steep. They have formed in a layer of sandy material over glacial till. The largest area lies on the east side of the valley of the Rush River and extends from Maiden Rock to section 22 of Salem Township. Isolated smaller areas extend northward along the east rim of the valley. Others are in the western and northwestern parts of the county.

Representative profile of a cultivated Renova fine sandy loam, sandy variant:

0 to 8 inches, very dark grayish-brown, friable fine sandy loam.
8 to 16 inches, dark-brown, friable fine sandy loam.
16 to 22 inches, dark yellowish-brown, firm heavy fine sandy loam.
22 to 28 inches, dark-brown, firm sandy clay loam.
28 to 48 inches, dark-brown, firm clay loam.
48 inches +, fissured dolomite.

The sandy variants of the Renova series have moderately rapid permeability in the upper part of the profile and moderately slow permeability in the till. They have moderate available moisture capacity. Reaction is medium acid to strongly acid, and natural fertility is moderate. Soil characteristics are favorable for the deep penetration of roots.

These soils have potential for good yields. In this county they are not important for farming, however, because of their rather limited acreage.

Renova fine sandy loam, sandy variant, 2 to 6 percent slopes, eroded (RfB2).—This is a gently sloping soil of the ridgetops. Its profile is similar to the one described as typical for sandy variants of the Renova series. From one-third to two-thirds of the original surface layer has been lost through erosion, however, and the present surface layer is thinner and lighter colored than the original one.

Included in mapped areas of this soil are small areas of Renova fine sandy loam, sandy variant, 2 to 6 percent slopes. Also included are soils that have a surface layer of loamy fine sand.

If fairly simple practices are used to prevent erosion, and if good supplies of plant nutrients and lime are applied, Renova fine sandy loam, sandy variant, 2 to 6 percent slopes, eroded, can be cropped rather intensively. All of the acreage is cultivated. (Capability unit IIe–7, woodland suitability group 3)

Renova fine sandy loam, sandy variant, 6 to 12 percent slopes, eroded (RfC2).—This soil has been used for crops without being properly protected. As a result, it is eroded.

Included with this soil in mapping are small areas of Renova fine sandy loam, sandy variant, 6 to 12 percent slopes, and areas of soils that have a surface layer of loamy fine sand. Also included are small areas of soils that are severely eroded.

Renova fine sandy loam, sandy variant, 6 to 12 percent slopes, eroded, is suited to row crops, small grains, and hay, but careful management is necessary to control further erosion. Practices that conserve moisture are also needed. (Capability unit IIIe–7, woodland suitability group 3)

Renova fine sandy loam, sandy variant, 12 to 20 percent slopes, eroded (RfD2).—This soil has been cultivated along with less sloping soils. As a result, in most places it has lost from one-third to two-thirds or more of its original surface layer through erosion. The present surface layer is lighter colored than the original one, and the subsoil is exposed in some spots. Included with this soil in mapping are small areas of Renova fine sandy loam, sandy variant, 12 to 20 percent slopes.

Generally, bedrock is nearer the surface than in the less sloping and less eroded sandy variants. Tilth is poorer than in similar soils that are not eroded. The content of organic matter is low, and the rate of infiltration is slow. The hazard of water erosion is severe, and there is a slight hazard of wind erosion. In addition, this soil is somewhat droughty during extended dry periods.

This soil is not well suited to row crops, but it can be used for hay or pasture. It can also be used for trees or to provide food and cover for wildlife. If contour stripcropping is practiced, a suitable cropping system consists of 2 years of small grains followed by 3 years of meadow. Such a cropping system provides adequate control of erosion and also conserves water to some extent. (Capability unit IVe–7, woodland suitability group 3)

Riverwash

Riverwash (Rh) consists of loose sand and gravel that have been recently deposited in stream channels or in intermittent drainageways. Most commonly, it occurs along the major streams. Because the soil material is droughty, and because new material is deposited frequently, the areas support little or no useful vegetation. In some places, however, the soil material has been left undisturbed long enough for the growth of a sparse stand of willow, river birch, and some scrub oak.

Riverwash is open and porous, and it has very low available moisture capacity. This land type is very droughty, although depth to the water table is less than 5 feet in some places. Natural fertility is very low. Flooding is likely to be frequent. This land type is subject to change as a result of erosion and deposition during periods when the water is high. It can be used for wildlife. All of the acreage is idle. (Capability unit VIIIs–10, woodland suitability group 11)

Rockton Series

The Rockton series consists of moderately deep, well-drained soils that are nearly level to moderately steep. These soils are on outwash plains and on rock-formed terraces in broad valleys in the northwestern part of the county. They have formed in loamy material over fissured dolomite.

Representative profile of Rockton loam that is cultivated:

0 to 12 inches, black, friable loam.
12 to 25 inches, dark-brown and dark yellowish-brown, friable loam.
25 to 31 inches, dark-brown, friable heavy loam.
31 inches +, partly weathered fissured dolomite.

The Rockton soils are moderately permeable and have moderate available moisture capacity. They are slightly acid. Their root zone extends to the dolomite or to material weathered from dolomite. Natural fertility is moderately high.

Rockton complex, 2 to 6 percent slopes (RoB).—These soils have a profile similar to the one described for the series. They are gently sloping and are slightly susceptible to erosion. Included in mapped areas of these soils are small areas of nearly level Rockton soils and of Rockton soils that are moderately eroded.

The soils of Rockton complex, 2 to 6 percent slopes, are suited to all of the crops commonly grown in the county. In dry years or during growing seasons when rainfall is poorly distributed, yields may be slightly lowered by lack of moisture. Suggested management includes practices that control erosion, as well as practices that conserve water. In the small areas of included soils that are already moderately eroded, especially careful attention should be given to protecting these soils. Because part of the organic matter has already been lost from those areas, further erosion is a greater hazard than where the soils are not already eroded. (Capability unit IIe–2, woodland suitability group 12)

Rockton complex, 6 to 12 percent slopes, moderately eroded (RoC2).—The soils of this complex are on the edges of rock-formed terraces. Runoff is moderately rapid, and further erosion is a moderate hazard. These sloping soils are more droughty than the soils of Rockton complex, 2 to 6 percent slopes, and they can be used less intensively for cropping. Where practices are used that control erosion, however, row crops can be grown. (Capability unit IVe–3, woodland suitability group 12)

Rozetta Series

The Rozetta series consists of soils that are deep and moderately well drained. These soils have formed on stream terraces in a layer of silty material more than 42 inches thick. They are nearly level to sloping.

Representative profile of Rozetta silt loam, benches, that has been cultivated.

0 to 8 inches, very dark grayish-brown, friable silt loam.
8 to 12 inches, dark grayish-brown, friable silt loam.
12 to 17 inches, brown, friable silt loam.

17 to 31 inches, dark-brown, firm silt loam; a few, fine, dark-brown mottles.
31 to 42 inches, dark-brown, firm silt loam; many, fine, distinct mottles.
42 ~~inches~~ +, dark-brown, friable silt loam; a few, fine, distinct mottles.

The Rozetta soils have moderate permeability and moderately high available moisture capacity. Natural fertility is high, and good response is received if fertilizer is applied. These soils are easy to till, but they dry out more slowly in spring than the well-drained soils. Their root zone is deep.

Rozetta silt loam, benches, 0 to 2 percent slopes (RtA).—This soil has a profile similar to the one described for the series. It is nearly level and occurs in broad areas.

Included in mapped areas of this soil are small, low-lying areas of a somewhat poorly drained Curran silt loam, which is not mapped separately in this county. Areas of this included soil are generally less than 1 acre in size.

Runoff is slow. Therefore, there is little risk of erosion. The slow runoff and excess moisture make this soil warm up slowly in spring. Seepage or runoff from the adjoining uplands makes some of the areas excessively wet in spring or after periods of extended rainfall.

This soil is well suited to corn, small grains, and forage crops, and good yields may be expected. If a suitable cropping system is used, and if the supply of plant nutrients is maintained, crops can be grown intensively. The crops respond well to applications of a complete fertilizer, but corn requires supplemental applications of nitrogen. Lime is also needed for high yields of legumes. (Capability unit I–1, woodland suitability group 1)

Rozetta silt loam, benches, 2 to 6 percent slopes (RtB).—The profile of this soil is similar to the profile described for the series. In places, however, the surface layer is slightly thinner. Small areas of Rozetta silt loam, benches, 2 to 6 percent slopes, moderately eroded, are included in the areas mapped.

Runoff is not excessive, but control of erosion is needed. If the supply of plant nutrients is maintained, and if fairly simple practices are used to control erosion, cropping can be intensive. The crops respond well if a complete fertilizer and manure are added. Supplemental applications of nitrogen are needed for high yields of corn, and lime is required for high yields of legumes. The lime should be applied according to the needs indicated by the results of soil tests. (Capability unit IIe–1, woodland suitability group 1)

Sable Series

The Sable series consists of deep, very poorly drained soils that are silty. These soils occupy small, scattered areas within larger areas of Otterholt soils. They are mainly in the eastern part of the county.

Representative profile of Sable silt loam in a pastured drainageway:

0 to 10 inches, black, friable silt loam.
10 to 48 inches, olive-gray, firm heavy silt loam; yellowish-brown mottles.
48 inches +, grayish-brown, firm clay loam; many brown mottles.

The Sable soils have moderately slow permeability and slow internal drainage. They have high available moisture capacity and high natural fertility. Reaction is neutral to mildly alkaline or moderately alkaline. The root zone for most crops is 6 to 18 inches deep. The very poor drainage appears to be caused mainly by seepage.

In years when the amount of precipitation is normal, moderate yields of corn and hay can be obtained on these soils without artificial drainage. These soils, however, occupy only a small acreage. In this county they have little importance for farming.

Sable silt loam (0 to 3 percent slopes) (Sa).—This is the only Sable soil mapped in Pierce County. It occurs in areas where it receives seepage and runoff from the adjacent slopes. As a result, only a small part of the acreage has been cultivated.

This soil is suitable for tile drainage. Diverting the runoff and improving the surface drainage or subsurface drainage are suggested to remove the excess water. Water erosion is also a slight hazard, but the hazard can be reduced by diverting the runoff from adjacent areas. If drainage is improved, this soil can be cropped fairly intensively. (Capability unit IIw–1, woodland suitability group 12)

Santiago Series

The Santiago series consists of well-drained soils that are silty. These soils have formed in 12 to 30 inches of windblown silty material (loess) over glacial till that has a texture of sandy loam. They are gently sloping or sloping and occur in scattered areas on ridgetops in the northern part of the county.

Representative profile of a cultivated Santiago silt loam:

0 to 8 inches, very dark grayish-brown, very friable silt loam.
8 to 12 inches, dark-brown, very friable silt loam.
12 to 20 inches, grayish-brown, friable silt loam.
20 to 33 inches, reddish-brown to dark-brown, firm loam.
33 to 48 inches +, dark-brown, friable sandy clay loam.

Santiago soils have moderate permeability, medium internal drainage, and high available moisture capacity. Reaction is slightly acid to very strongly acid. Natural fertility is moderately low. The acid reaction indicates the need for lime. Where lime has been added, response to applications of fertilizer is moderate. These soils are suited to all the locally grown crops. In this county, however, they do not have a large enough acreage to be important to farming.

Santiago silt loam, 2 to 6 percent slopes (SbB).—This soil has the profile described for the series. It is gently sloping, and it occupies broad areas of uplands. This soil is productive and is desirable for crops. Where erosion has not been a problem, and where the slopes are between 2 and 4 percent, crops are grown. The rest of the acreage is in permanent pasture or trees. Runoff is rather slow, and the hazard of erosion is slight.

In cultivated areas of this soil, only simple practices are needed to control erosion. Row crops can be grown 2 years out of 5 if stripcropping is practiced. If the fields are terraced, the cropping system may be more intensive. (Capability unit IIe–1, woodland suitability group 1)

Santiago silt loam, 2 to 6 percent slopes, moderately eroded (SbB2).—This is a gently sloping soil in broad areas of uplands. It has been cultivated and in most places

it has lost from one-third to two-thirds of the original surface layer through erosion. The present surface layer is grayish brown. It is lighter colored than the original one, and it contains less organic matter and is in poorer tilth. In some spots the dark-brown subsoil is exposed. The present surface layer is generally about 6 to 8 inches thick, however, in most of the acreage. The profile of this soil is in other respects similar to the one described for the series.

Further erosion is a slight hazard. The rate of infiltration is slower in the present surface layer than in the original one, and this slightly increases the hazard of further erosion. Fairly simple practices to control erosion and to conserve water are needed to keep this soil in good tilth. (Capability unit IIe-1, woodland suitability group 1)

Santiago silt loam, 6 to 12 percent slopes, moderately eroded (SbC2).—This is a sloping soil of the uplands. It has been cultivated, and in most places it has lost from one-third to two-thirds of its original surface layer through erosion. The present surface layer is generally 4 to 8 inches thick. In some spots, however, the subsoil has been exposed by tillage, and the present surface layer in those areas is dark brown. The profile is similar to the one described for the series, but the present surface layer is lighter colored and thinner. Also, the profile is less deep over glacial till.

The content of organic matter is lower than it was before this soil was eroded, and tilth is poorer. The loss of organic matter and poorer tilth have, in turn, made this soil more susceptible to erosion. The hazard of further erosion is moderate. Nevertheless, row crops can be grown if practices are used to control erosion. If contour stripcropping is practiced, row crops may be grown 1 year out of 5. (Capability unit IIIe-1, woodland suitability group 1)

Sargeant Series

The Sargeant series consists of deep, somewhat poorly drained, silty soils that are nearly level to sloping. These soils are on the uplands throughout the northern half of the county. To a limited extent, they also occur in seep spots in sloping areas. They have formed in a moderately thin layer of silty loess over glacial till.

Representative profile of Sargeant silt loam:

0 to 4 inches, very dark gray, friable silt loam.
4 to 7 inches, grayish-brown, very friable silt loam; many brown to yellowish-brown mottles.
7 to 11 inches, brown, friable silt loam; many, medium, grayish-brown to yellowish-brown mottles.
11 to 16 inches, brown, firm heavy silt loam; many, medium, dark yellowish-brown mottles and light yellowish-brown silt coats.
16 to 35 inches, yellowish-brown, plastic clay loam; many, coarse, grayish-brown to strong-brown mottles.
35 to 42 inches +, brown to yellowish-brown, plastic clay loam; coarse, grayish-brown to light olive-brown mottles.

Sargeant soils have slow internal drainage. They have moderately slow permeability throughout the clay loam till that makes up the lower part of the subsoil and the substratum. Also, nearly level areas of these soils are wet for significant periods of time. The moisture-supplying capacity is high. These soils have a root zone deep enough for the crop plants ordinarily grown. Natural fertility is moderately high, but the crops respond well to applications of fertilizer and lime.

These soils are suited to all of the crops commonly grown in the area, but they are of only minor importance for farming. Surface drainage may be necessary for successful growth of some crops.

Sargeant silt loam, 0 to 2 percent slopes (SgA).—This is a nearly level soil in drainageways and on flats in the uplands. It receives water from the adjoining areas. The profile is similar to the one described for the series, except that the surface layer is thicker.

Surface drainage is slow, and this soil also has a slowly permeable layer within the profile. Drainage is needed for optimum yields because this soil is wet for significant periods of time. Diversions may be used to intercept runoff from adjoining areas.

If suitable practices are used to control excess water, this soil may be cropped fairly intensively. Row crops can be grown year after year if the content of organic matter is kept high, and if the supply of plant nutrients is maintained, minimum tillage is practiced, and good tilth and favorable soil structure are preserved. (Capability unit IIw-2, woodland suitability group 7)

Sargeant silt loam, 2 to 6 percent slopes (SgB).—This soil is in drainageways and on seep slopes of glacial till plains in the uplands. Its profile is the one described for the series.

Where this gently sloping soil is in drainageways, it is flooded occasionally for short periods. It is slightly susceptible to water erosion. Drainage must be provided to remove the excess water, or the yields of most crops will be lowered. Diversions may be used to intercept runoff that drains onto this soil from the adjoining areas. (Capability unit IIw-2, woodland suitability group 7)

Sargeant silt loam, 2 to 6 percent slopes, moderately eroded (SgB2).—This soil, like Sargeant silt loam, 2 to 6 percent slopes, is in drainageways and on seep slopes of glacial till plains in the uplands. In most places the slopes are between 4 and 6 percent. Runoff has caused erosion in areas where this soil has not been protected. From one-third to two-thirds of the original surface layer has been lost through erosion. The present surface layer contains less organic matter, has poorer structure, and has lower natural fertility than the original one, and it is also more susceptible to erosion.

This soil has about the same limitations as Sargeant silt loam, 2 to 6 percent slopes, and management is similar. It is suited to all of the crops commonly grown in the area if suitable practices are used to control water erosion. (Capability unit IIw-2, woodland suitability group 7)

Sargeant silt loam, 6 to 12 percent slopes (SgC).—This soil occurs mainly near the sources of the major streams in the county. It has a profile similar to the one described for the series. The surface layer is slightly thinner, however, and the silty material is a few inches thinner over glacial till. This sloping soil is wet, mainly because water is received as the result of seepage. The seepage is caused by water that moves laterally over the layer of slowly permeable till to a point where it can enter the root zone. Included in the mapped areas of this soil are areas in which the slopes are steep.

Sargeant silt loam, 6 to 12 percent slopes, is mainly in permanent pasture or in woods. It is moderately

susceptible to water erosion, as well as being somewhat poorly drained. Disposing of the excess water by installing waterways or diversions results in higher yields of crops. In the steep included areas, more intensive practices are needed to control erosion than in other places. (Capability unit IIIe–8, woodland suitability group 7)

Sargeant silt loam, 6 to 12 percent slopes, moderately eroded (SgC2).—This soil occurs in areas similar to those occupied by Sargeant silt loam, 6 to 12 percent slopes. It is cultivated and has lost from one-third to two-thirds of its original surface layer through erosion. The present surface layer is 4 to 6 inches thick and is lighter colored than the surface layer in areas that are not eroded. Also, it contains less organic matter, has less favorable structure, and has lower natural fertility.

This soil is slightly more susceptible to further erosion than the uneroded Sargeant silt loam, 6 to 12 percent slopes. Limitations of the two soils are similar, however, and management is about the same.

This soil is not suited to row crops, unless practices are used to control erosion. If contour stripcropping is practiced, a cropping system consisting of 2 years of row crops, 1 year of a small grain, and then 3 years of meadow provides adequate control. Diversions are needed in areas where this soil receives runoff from adjacent areas. This soil is suited to all the locally grown crops. (Capability unit IIIe–8, woodland suitability group 7)

Schapville Series

The Schapville series consists of silty soils that are moderately well drained or well drained. These soils are sloping to moderately steep and have formed in a moderately thin layer of silty loess over shale. They occur on upland ridges that are capped by shale and are mantled by loess. The areas are primarily in the north-central part of the county. The largest area extends from Beldenville northward to the county line.

Representative profile of a Schapville silt loam that has not been cultivated:

0 to 12 inches, black, friable silt loam.
12 to 16 inches, very dark grayish-brown, firm heavy silt loam.
16 to 23 inches, yellowish-brown, very firm silty clay loam; dark-brown mottles.
23 to 27 inches, olive-gray, very firm silty clay loam; dark-brown mottles.
27 inches +, olive-gray, very firm shale; many, fine, distinct, yellowish-brown mottles in the upper part.

Permeability is moderately slow in the silty upper part of the Schapville profile, and it is slow in the shale substratum. Internal drainage is medium. These soils have moderate available moisture capacity. They are slightly acid to medium acid, but the underlying shale is neutral to mildly alkaline in reaction. Roots can penetrate to the shale substratum. Natural fertility is moderate, but crops grown on these soils respond well to applications of fertilizer.

These soils are suited to all the crops grown in the county. They are not significant to the farming, however, because of their rather limited acreage.

Schapville silt loam, 6 to 12 percent slopes (ShC).—This soil is on ridgetops in areas not well suited to cultivation. Most of the areas are wooded or in permanent pasture. In the wooded areas, this soil is protected by a cover of leaf litter and it has sustained no noticeable erosion. The profile is the one described for the series.

If this soil is cultivated, careful management is required that will control erosion. The hazard of erosion is moderate, and droughtiness is also somewhat of a hazard. Row crops can be grown only where the slopes are short, and then only if contour stripcropping is practiced. This soil can be managed for sustained production of timber if it is properly managed and protected from grazing. (Capability unit IVe–3, woodland suitability group 12)

Schapville silt loam, 6 to 12 percent slopes, moderately eroded (ShC2).—The surface layer of this soil is thinner than the one in the profile described for the series. In places spots of grayish-brown soil material are exposed where part of the subsoil has been mixed with the surface soil by tillage. In some places erosion has removed as much as two-thirds of the original surface layer. The present surface layer is 8 to 10 inches thick in most places.

This soil is moderately susceptible to erosion, and it is also somewhat droughty. Nearly all of the acreage is cultivated. In the cultivated areas, practices that conserve moisture and that also control erosion are needed. Contour stripcropping is the preferred practice.

This soil is suitable for pasture, trees, or wildlife areas. If it is cultivated, the cropping system should not include row crops. (Capability unit IVe–3, woodland suitability group 12)

Schapville silt loam, 12 to 20 percent slopes, moderately eroded (ShD2).—This soil has lost from one-third to two-thirds of its original surface layer through erosion. The present surface layer is about 6 to 8 inches thick, and it is very dark grayish brown in most places. The profile is thinner over the olive-gray shaly material than the one described for the series. The thickness of the soil material over shaly material ranges from about 12 to 26 inches. Small areas of Schapville silt loam, 12 to 20 percent slopes, are included in mapped areas of this soil.

Schapville silt loam, 12 to 20 percent slopes, moderately eroded, is not suited to cultivated crops. Moderately high yields of forage crops are obtained, however, if this moderately steep soil is well managed and is protected from erosion. Lime and fertilizer are beneficial. The kinds and amounts to apply should be determined according to the needs indicated by the results of soil tests and the requirements of the crop to be grown. (Capability unit VIe–3, woodland suitability group 12)

Schapville silt loam, 20 to 30 percent slopes, eroded (ShE2).—This is a steep soil on the side slopes of upland ridges. Much of the acreage has been cultivated, and as much as two-thirds of the original surface layer has been lost through erosion in most places. The present surface layer is slightly thinner and lighter colored than the one in the profile described for the series. Also, the profile is shallower over shale bedrock in most places. Included in mapped areas of this soil are small areas of Schapville soils that are even shallower over bedrock than this soil. In some places shale bedrock is exposed.

The hazard of further erosion is very severe. Schapville silt loam, 20 to 30 percent slopes, eroded, is suitable for pasture, however, and it can be used as woodland or to provide food and cover for wildlife. A good sod should be maintained in the pastured areas by controlling graz-

ing so that an adequate cover of plants will remain. (Capability unit VIIe-3, woodland suitability group 12)

Schapville Series, Wet Subsoil Variants

The wet subsoil variants of the Schapville series are like the Schapville soils in many respects. They vary, however, in some characteristics. They are silty and are gently sloping, but unlike the Schapville soils, they are somewhat poorly drained. These soils have formed in a moderately thin layer of silty loess over shale. They are mainly in the north-central part of the county, on shale-capped upland ridges that are covered by a mantle of loess.

Representative profile of a cultivated Schapville silt loam, wet subsoil variant:

0 to 9 inches, black, friable silt loam.
9 to 12 inches, dark grayish-brown, friable silt loam; few, fine, yellowish-brown mottles.
12 to 21 inches, brown, firm heavy silt loam; few, fine, yellowish-brown mottles.
21 to 23 inches +, olive-gray, firm silty clay (weathered shale); has strong-brown mottles; sticky when wet.

Wet subsoil variants of the Schapville series have moderately slow permeability in the silty upper part of the profile, but they have slow permeability in the shale substratum. Internal drainage is slow, and the available moisture capacity is high. Generally, these soils are slightly acid to medium acid, but the surface layer has a neutral reaction in areas that have been limed. The reaction is slightly acid to mildly alkaline in the underlying shale. Roots can penetrate to the shale substratum. These soils have moderate natural fertility. They are wet because they receive runoff and seepage from the adjoining areas. Their small acreage in Pierce County and the limitations of somewhat poor drainage make these soils of little importance for farming.

Schapville silt loam, wet subsoil variant, 2 to 6 percent slopes, eroded (SkB2).—This soil is adjacent to and below areas of sloping soils, and it receives runoff from those soils. The runoff has caused erosion. From one-third to two-thirds of the original surface layer has been lost through erosion, and the present surface layer has poor structure and low natural fertility. The slopes are mainly between 4 and 6 percent. Included in mapped areas of this soil are small areas of Schapville silt loam, wet subsoil variant, 2 to 6 percent slopes.

Further water erosion is a moderate hazard, and controlling seepage is a problem. Tile drainage can be used where the shale bedrock does not interfere with installing the tile.

If suitable practices are used to control excess water, this soil is suited to all the crops commonly grown in this area. Most of the areas are cultivated. (Capability unit IIw-3, woodland suitability group 12)

Seaton Series

The Seaton series consists of deep, silty soils that are well drained and that are gently sloping to steep. These soils have formed on upland ridges and valley slopes in a mantle of coarse, silty loess that is more than 42 inches thick. They occur throughout the county but are most extensive in the southern half.

Representative profile of a Seaton silt loam that has not been cultivated.

0 to 6 inches, very dark brown, very friable silt loam.
6 to 10 inches, brown, friable silt loam.
10 to 70 inches +, dark-brown, friable silt loam.

The Seaton soils have moderate permeability and high available moisture capacity. Natural fertility is high, but crops grown on these soils respond well to applications of fertilizer. The reaction ranges from slightly acid to very strongly acid. The root zone is deep enough for the roots of most plants grown for crops.

These soils are highly desirable for farming. They are suited to all the crops grown locally.

Seaton silt loam, 2 to 6 percent slopes (SnB).—This is a gently sloping soil on broad upland ridges. Its profile is the one described for the series.

This soil has no serious limitations. It is highly desirable for crops and is suited to all the crops grown locally. Almost all of the acreage, however, is in permanent pasture or is wooded. Field crops are grown where the slopes are between 2 and 4 percent and where erosion has not been a problem. Managing this soil involves controlling erosion and maintaining the content of organic matter, the supply of plant nutrients, and the good soil structure. (Capability unit IIe-1, woodland suitability group 1)

Seaton silt loam, 2 to 6 percent slopes, moderately eroded (SnB2).—The profile of this soil is similar to the one described for the series. All of the acreage has been cultivated, and in most places from one-third to two-thirds of the original surface layer has been lost through erosion. The present surface layer is generally about 6 inches thick and has a grayish-brown color. In some cultivated areas, however, part of the subsoil has been turned up by tillage and the surface layer in those areas is dark brown. The present surface layer contains less organic matter and is in poorer tilth than the surface layer of Seaton silt loam, 2 to 6 percent slopes.

Because this soil is already moderately eroded, it is more susceptible to further erosion than Seaton silt loam, 2 to 6 percent slopes. Nevertheless, management of the two soils is similar. Contour farming or contour stripcropping are effective practices for controlling erosion. (Capability unit IIe-1, woodland suitability group 1)

Seaton silt loam, 6 to 12 percent slopes (SnC).—This soil occupies convex slopes on the tops of ridges. It has been used primarily for trees or pasture. Little erosion has taken place, but the hazard of erosion is moderate. The profile is less deep than the one described for the series.

If crops that require tillage are grown, practices are needed to protect this sloping soil from erosion. Row crops should not be grown where the slopes are longer than 300 feet, unless such practices as contour stripcropping or terracing are used to protect the soil. (Capability unit IIIe-1, woodland suitability group 1)

Seaton silt loam, 6 to 12 percent slopes, moderately eroded (SnC2).—This is a sloping soil on ridges and on valley slopes. It has been cultivated, and in most places it has lost from one-third to two-thirds of its original surface layer through erosion. The present surface layer is generally 4 to 8 inches thick. It is lighter colored than the one in the profile described for the series, and it con-

tains less organic matter than the original one. In some spots the subsoil has been exposed by tillage and the present surface layer is dark brown. The profile is generally thinner than the one described for the series.

This soil has about the same limitations as Seaton silt loam, 6 to 12 percent slopes. The surface layer is more susceptible to erosion, however, as a result of the loss of organic matter and poorer tilth. Needed management practices are ones that protect the soil from erosion. Erosion can be adequately controlled by contour stripcropping. (Capability unit IIIe–1, woodland suitability group 1)

Seaton silt loam, 6 to 12 percent slopes, severely eroded (SnC3).—This is a sloping soil on ridges and valley slopes. It has been cultivated. More than two-thirds of the original surface layer has been lost through erosion, and the subsoil is exposed in much of the acreage. The present surface layer has a dark-brown color, is low in content of organic matter, and is difficult to keep in good tilth. The rate at which water infiltrates is slower and runoff is more rapid than before this soil was eroded. The hazard of further erosion is moderate to severe.

Barnyard manure and commercial fertilizer are needed to build up the supply of plant nutrients. They also increase the rate of infiltration and improve tilth. Controlling erosion is important because this soil is more susceptible to erosion than it originally was. (Capability unit IIIe–1, woodland suitability group 1)

Seaton silt loam, 12 to 20 percent slopes (SnD).—This is a moderately steep soil on the side slopes of ridges. The hazard of erosion is severe, but little erosion has taken place. The surface layer is thinner than the one in the profile described for the series. The profile is generally shallower over bedrock than the profiles of less sloping soils.

This soil is suitable for use as woodland or for permanent pasture. Most of the acreage is used for those purposes. Where field crops are grown, intensive practices are needed to control erosion. If this soil is used for pasture, a firm sod can be maintained by controlling grazing so that an adequate cover of plants will remain. Livestock should be discouraged from making trails where water can concentrate and cause gullying. Sustained production of hardwood timber can be maintained if the wooded areas are protected from fire and grazing. (Capability unit IVe–1, woodland suitability group 1)

Seaton silt loam, 12 to 20 percent slopes, moderately eroded (SnD2).—This soil lies below areas of less sloping Seaton soils on the ridgetops, and it receives runoff from those soils. It has been cultivated and has lost from one-third to two-thirds of its original surface layer through erosion. The present surface layer contains some material from the subsoil that has been mixed with the surface soil by tillage. It is lighter colored than the one in the profile described for the series. Also, the profile is generally shallower over bedrock than the one described.

This soil can be used for hay. If it is used for field crops, it is highly susceptible to further erosion. A suitable cropping system is one in which row crops are grown infrequently. (Capability unit IVe–1, woodland suitability group 1)

Seaton silt loam, 12 to 20 percent slopes, severely eroded (SnD3).—This is a sloping soil on ridges and valley slopes. It has lost more than two-thirds of its original surface layer through erosion. In most places the present surface layer is only about 4 inches or less thick, and the dark-brown subsoil is exposed in much of the acreage. The content of organic matter is low, and good tilth is difficult to maintain. Also, the rate at which water infiltrates is slow, runoff is extensive, and the hazard of further erosion is severe. Gullying is difficult to control in the drainageways.

This soil can be used for hay or pasture. A suitable cropping system is one that does not include row crops. Large applications of barnyard manure and commercial fertilizer are needed to return this soil to a high level of productivity. (Capability unit IVe–1, woodland suitability group 1)

Seaton silt loam, 20 to 30 percent slopes (SnE).—This soil is in narrow areas on the side slopes of ridges, below less sloping soils on the ridgetops. It generally occurs with Dubuque soils, but it is deeper over bedrock than those soils. The slopes are plane or concave. This steep soil has been used mainly for trees, and little erosion has taken place. Its profile is generally thinner over bedrock than the one described for the series. The hazard of further erosion is very severe.

This soil is not suited to cultivation, but it can be used for hay or pasture. It can also be used as woodland or to provide food and cover for wildlife. Erosion can be controlled in the pastures by carefully controlling grazing and keeping runoff from concentrating in trails made by livestock. Sustained production of hardwood timber can be maintained by protecting the woodland from fire and grazing. (Capability unit VIe–1, woodland suitability group 1)

Seaton silt loam, 20 to 30 percent slopes, moderately eroded (SnE2).—This soil is on the side slopes of ridges. Its profile is thinner than the one described for the series. Also, the surface layer is lighter colored and is lower in content of organic matter. The hazard of further erosion is very severe.

This soil is too steep for cultivation, but it can be used for hay or pasture. The forage crops need moderate applications of fertilizer. Control of grazing helps to prevent further erosion and increases the yields of forage crops. Where feasible, erosion can be controlled by planting trees. If trees are planted, they need protection from fire and grazing. Other practices suitable for woodland are described in the section "Woodland Uses of the Soils." (Capability unit VIe–1, woodland suitability group 1)

Sogn Series

The Sogn series consists of well-drained silt loams. These soils are generally less than 12 inches deep over dolomite, but they are as much as 20 inches deep in some places. They are generally steep or occur on breaks near steep slopes.

Representative profile of Sogn silt loam:

0 to 10 inches, black, friable silt loam.
10 inches +, fractured dolomite.

The Sogn soils have very low available moisture capacity. Their capacity to hold plant nutrients is also low.

Sogn-Rockton loams, 0 to 2 percent slopes (SoA).—The principal soils of this mapping unit are Sogn silt loam and Rockton loam. These nearly level soils are on rock-formed terraces. Runoff is slow. Water erosion is not a hazard, but there is a slight hazard of wind erosion in some sandy areas. The available moisture capacity is low, and these soils are droughty. The Rockton soil has a layer of clayey material above the dolomite in some places. In those areas the available moisture capacity is higher than in areas where this layer is very thin or is lacking. (Capability unit IVs–3, woodland suitability group 12)

Sogn-Rockton loams, 2 to 6 percent slopes (SoB).—Sogn silt loam and Rockton loam are the principal soils in this mapping unit. Runoff is moderately slow, and the hazard of erosion is slight. Management practices are needed that help to control erosion and that also conserve moisture. (Capability unit IVs–3, woodland suitability group 12)

Sogn-Rockton loams, 6 to 12 percent slopes, moderately eroded (SoC2).—The soils of this unit are on the edges of terraces that border drainageways and escarpments. The principal soils are Sogn silt loam and Rockton loam. In most places these sloping soils have lost from one-third to two-thirds of their original surface layer through erosion, and they are susceptible to further erosion. In some spots bedrock is within plow depth. Where bedrock is near enough to the surface to interfere with tillage, these soils can be used for hay or pasture. (Capability unit VIe–3, woodland suitability group 12)

Sogn-Rockton loams, 12 to 20 percent slopes, moderately eroded (SoD2).—This mapping unit consists mainly of moderately steep areas of Sogn silt loam and Rockton loam. These soils are on the edges of limestone terraces. Runoff is rapid, and the hazard of further erosion is severe. These soils are more droughty than the less sloping soils of the Sogn-Rockton mapping units. Included in the areas mapped are small areas of Sogn loam and of Rockton loam.

The surface layer is low in content of organic matter. It is less friable and is in poorer tilth than the surface layer in uneroded areas of the Sogn-Rockton mapping units. Rock outcrops are numerous, and in many areas bedrock is near the surface. (Capability unit VIIe–3, woodland suitability group 12)

Sparta Series

The Sparta series consists of deep soils that are sandy and excessively drained. These soils are on terraces bordering the Mississippi, St. Croix, and Kinnickinnic Rivers. They are nearly level to sloping.

Representative profile of Sparta loamy sand:

0 to 17 inches, very dark brown, very friable loamy sand.
17 to 60 inches +, brown to yellowish-brown, loose fine sand.

Sparta soils have very rapid permeability, very rapid internal drainage, and very low available moisture capacity. Consequently, they are droughty. Even for fair yields, good management and good distribution of rainfall during the growing season are needed. The soil reaction ranges from neutral to medium acid. Natural fertility is low, and the response to fertilizer is only moderate. These soils do not have a restricted root zone. The lack of fine-textured binding material in the surface layer makes them susceptible to erosion by wind and water.

Sparta loamy sand, 0 to 2 percent slopes (SpA).—This is a nearly level soil that has the profile described for the series. The largest area is on the terrace of the Mississippi River, between Bay City and Hager City.

Permeability is rapid, and not much water is lost through runoff. Therefore, water erosion is only a slight hazard.

If this soil is properly managed, it can be used for row crops, small grains, and hay. Most of the acreage is cultivated. Crop yields are generally low, however, because of the low natural fertility and low available moisture capacity. During seasons when the amount of rainfall is below normal, or when the rainfall is poorly distributed throughout the growing season, yields are especially low. Early maturing and deep-rooted crops generally make better yields on this soil than other crops. Protection is needed from wind erosion. It can be provided by practicing stripcropping or planting shelterbelts of trees and shrubs. (Capability unit IVs–3, woodland suitability group 4)

Sparta loamy sand, 2 to 6 percent slopes (SpB).—This is a gently sloping or gently undulating soil. Its profile is similar to the one described for the series. In some places as much as one-third of the original surface layer has been lost through erosion by wind and water.

This soil can be used for early maturing or deep-rooted crops. Most of the acreage is cultivated, but crop yields are generally low. Practices that help to control erosion must be practiced intensively, and fertilizer, lime, and organic matter are needed. (Capability unit IVs–3, woodland suitability group 4)

Sparta loamy sand, 2 to 6 percent slopes, eroded (SpB2).—The profile of this soil is similar to the one described for the series, but the surface layer is thinner as a result of erosion. This soil is gently sloping in some places and is gently undulating in others. It is highly susceptible to further erosion by wind, and special management is needed to protect it.

This soil is suitable for cultivation, but the low available moisture capacity, coarse texture, and low fertility limit yields. Some areas that were formerly cultivated have been abandoned for crops and are idle. Those areas are suitable for planting to pine trees. (Capability unit IVs–3, woodland suitability group 4)

Sparta loamy sand, 6 to 12 percent slopes, eroded (SpC2).—This soil has lost part of its original surface layer through erosion by wind and water. The present surface layer is 8 to 10 inches thick, or thinner than the one in the profile described for the series. Included in mapped areas of this soil are small areas of Sparta loamy sand, 6 to 12 percent slopes.

Droughtiness and erosion are severe hazards that greatly limit the use of Sparta loamy sand, 6 to 12 percent slopes, eroded, for farming. Most of the acreage has been cultivated, but many areas are now being planted to pines. Some areas are in pasture or are idle. If this soil is protected from erosion and is well managed, forage crops can be grown for hay or pasture. Deep-rooted crops, such as some legumes and grasses, can be grown. This soil is also suitable for pine trees,

especially where protection from erosion is not feasible. (Capability unit VIs-3, woodland suitability group 4)

Spencer Series

The Spencer series consists of deep, moderately well drained soils that are silty. These soils have formed in a layer of silty loess that is 30 to 60 inches thick over glacial till. They are nearly level to sloping and are on uplands, mainly in the eastern part of the county.

Representative profile of a cultivated Spencer silt loam:

0 to 10 inches, very dark grayish-brown, friable silt loam.
10 to 37 inches, dark grayish-brown, firm silt loam; few, fine, strong-brown mottles.
37 to 44 inches, grayish-brown, friable silt loam; yellowish-brown mottles.
44 inches +, yellowish-brown, firm sandy clay loam till; few strong-brown mottles.

The Spencer soils are moderately permeable, have slow internal drainage, and have high available moisture capacity. In areas that have not been limed, they are medium acid to very strongly acid. They are neutral to mildly alkaline in areas that have been limed. These soils have moderately high natural fertility, but lime is needed in the areas that are acid. Where the proper amount of lime has been added, response to fertilizer is good. The depth to which roots can penetrate is not restricted. These soils are well suited to all of the locally grown crops, and they are important for farming.

Spencer silt loam, 0 to 2 percent slopes (SrA).—This soil occupies the nearly level parts of upland plains. It is generally in broad drainageways where soil material accumulates from the adjacent areas. The surface layer is dark colored and is thicker than that of the more sloping Spencer soils. Also, this soil is normally deeper over glacial till than the more sloping Spencer soils.

This soil receives runoff from the adjacent, higher lying areas. Surface runoff is very slow. No noticeable erosion has taken place, although this soil has been cultivated.

If an adequate supply of plant nutrients and the content of organic matter are maintained, this soil can be used intensively for crops. No practices are needed to control erosion. (Capability unit I-1, woodland suitability group 1)

Spencer silt loam, 2 to 6 percent slopes (SrB).—This is a gently sloping soil, mainly on the highest parts of broad ridgetops. Its profile is like the one described for the series, except that the surface layer is slightly thicker. In most places the slopes are between 2 and 4 percent. Runoff is rather slow, and the hazard of water erosion is slight.

Almost all areas of this soil are in permanent pasture or wooded. This soil is highly desirable for field crops, however, and it is productive. In areas that are cultivated, only simple practices are needed to control erosion. Row crops can be grown 2 years out of 5 if contour stripcropping is practiced. A more intensive cropping system may be used if the fields are terraced. (Capability unit IIe-1, woodland suitability group 1)

Spencer silt loam, 2 to 6 percent slopes, moderately eroded (SrB2).—This soil has the profile described for the series. In most places it has lost from one-third to two-thirds of its original surface layer through erosion. The dark-brown subsoil is exposed in some spots. The present surface layer generally has a lighter color, contains less organic matter, and is in poorer tilth than the surface layer in areas of similar soils that are not eroded. Also, the rate of infiltration is slower.

The susceptibility of this soil to erosion has been slightly increased by the slower rate of infiltration and the poorer tilth of the surface layer. However, the hazard of further erosion is slight. Only simple practices that help to control erosion are needed to keep this soil in good tilth, and those practices should also help to conserve water. (Capability unit IIe-1, woodland suitability group 1)

Spencer silt loam, 6 to 12 percent slopes, moderately eroded (SrC2).—This is a sloping soil of the uplands. It has been cultivated, and erosion has removed from one-third to two-thirds of the original surface layer in most places. In some spots the subsoil is exposed. The present surface layer is generally 6 to 8 inches thick, or thinner than the surface layer in the profile described for the series. Also, glacial till is nearer the surface. The present surface layer is lighter colored, contains less organic matter, and is in poorer tilth than the surface layer in areas of similar soils that are not eroded. Small areas of Spencer silt loam, 6 to 12 percent slopes, are included in mapped areas of this soil.

Because erosion has removed organic matter and has left the surface layer in poorer tilth, Spencer silt loam, 6 to 12 percent slopes, moderately eroded, is more susceptible to erosion than it originally was. The hazard of further erosion is moderate. Row crops can be grown, however, if practices are used to protect this soil. (Capability unit IIIe-1, woodland suitability group 1)

Steep Stony and Rocky Land

Steep stony and rocky land (StF) is a land type made up of various kinds of soils that are shallow over bedrock. The areas contain many rock outcrops and large boulders (fig. 13). This land type is on breaks below upland ridges underlain by sandstone or limestone bedrock. It is steep. Where it occurs on the walls of valleys, the slopes are about 30 percent in some places. The bluffs are vertical, however, where this land type borders the Mississippi River.

The texture of the soil material between the outcrops of rock ranges from sand to silt. The upper parts of the areas, just below the ridgetops, are underlain by limestone bedrock and by shattered fragments of limestone that have been moved down the slopes by gravity. At the middle and lower elevations, the areas are underlain by sandstone bedrock and by fragments of sandstone and limestone. In those areas, the soil material is more variable in characteristics than that at higher elevations. It consists of material weathered from sandstone and also of silty loess.

The soil material in this land type is low in natural fertility. Runoff is very rapid on these steep slopes, and the hazard of erosion is very severe. Some of the areas are used for grazing, although yields are low.

This land is too steep for renovation or for topdressing with fertilizer. It is subject to gullying if run-

Figure 13.—**An area of Steep stony and rocky land. The severe hazards of erosion and droughtiness make this land type unsuitable for crops, but it can be used as woodland or to provide food and cover for wildlife.**

off is allowed to concentrate in trails made by cattle. The land can be used for timber or to provide food and cover for wildlife. The yields of timber are generally better on slopes that face north and east, however, than on slopes that face south and west. This is because the soil material is commonly deeper and more silty on the north- and east-facing slopes than on the slopes that face south and west.

Steep stony and rocky land occupies a large acreage, and it provides a habitat for much of the wildlife in the county. If the wooded areas are protected from grazing, leaves and other remains of plants accumulate. They help to slow runoff and control flooding of the streams below. (Capability unit VIIs–9, woodland suitability group 5)

Stronghurst Series

The Stronghurst series consists of somewhat poorly drained soils that are nearly level. These soils have formed on low stream terraces in a deep layer of windblown silty material (loess). They occur mainly a few miles north of Plum City along Plum Creek.

Representative profile of Stronghurst silt loam, benches:

0 to 9 inches, very dark grayish-brown, friable silt loam; many, dark-brown mottles in the lower part of the layer.
9 to 11 inches, dark-brown, friable silt loam; many, medium, yellowish-red mottles.
11 to 38 inches, dark-brown, firm silt loam; many, medium, yellowish-red and yellowish-brown mottles.
38 to 60 inches, dark-brown, friable silt loam; many, medium, strong-brown mottles.

Stronghurst soils are slowly permeable, have slow internal drainage, and have high available moisture capacity. In many places they receive runoff from the adjacent slopes. Runoff is slow, and these soils are subject to some ponding. In most places the root zone for most plants grown for crops does not extend below a depth of 20 inches. Deeper penetration is generally inhibited by the excess moisture and lack of air. Where these soils have been limed, the reaction of the surface layer is neutral. These soils are slightly acid to strongly acid, however, below a depth of 9 inches.

This soil is used mainly for crops. Because of its limited extent in this county, however, it is not important for farming.

Stronghurst silt loam, benches, 0 to 2 percent slopes (SuA).—This is the only Stronghurst soil mapped in Pierce County. Its profile is the one described for the series.

If this soil is drained and is well managed, good yields of corn, oats, and hay can be expected. Corn and small grains respond well if a nitrogen fertilizer is added, especially if the fertilizer is applied early in spring. A stand of alfalfa is hard to establish unless adequate drainage is provided. Lime is generally needed for good yields of legumes. Because of slow internal drainage, this soil cannot be worked early in spring. In some places erosion is a slight hazard. Draining this soil and providing waterways to remove the excess water will improve yields. (Capability unit IIw–2, woodland suitability group 7)

Tell Series

The Tell series consists of well-drained soils that are nearly level or gently sloping. These soils are on stream terraces. Some of the areas are in broad valleys or on the outwash plain in the northwestern part of the county. The material in which these soils formed is 24 to 42 inches of windblown silt (loess) over stratified outwash sand.

Representative profile of Tell silt loam:

0 to 12 inches, dark grayish-brown, friable silt loam.
12 to 25 inches, dark-brown, firm heavy silt loam.
25 to 27 inches, dark-brown, firm loam.
27 inches +, yellowish-brown, loose fine sand.

Tell soils are moderately permeable and have fair available moisture capacity. Internal drainage is medium. The reaction of the root zone ranges from neutral to strongly acid. The root zone extends downward to the sandy substratum, and its reaction ranges from neutral to strongly acid. Natural fertility is moderately high.

Tell silt loam, 0 to 2 percent slopes (TeA).—This is a nearly level soil in broad areas on stream terraces. Its profile is the one described for the series. There is little danger of erosion, but drought is a serious hazard. Where this soil occurs in the broad valleys in the northwestern part of the county, it has a finer textured substratum, has higher available moisture capacity, and is less droughty than where it occurs in other areas.

If desirable soil structure and favorable permeability are maintained, this soil can be cultivated intensively. Row crops can be grown year after year if all the crop residue is returned to the soil, if a good supply of plant nutrients and good tilth are maintained, and if minimum tillage is practiced. Yields are generally good if practices are used to conserve moisture. (Capability unit IIs–1, woodland suitability group 1)

Tell silt loam, 2 to 6 percent slopes, eroded (TeB2).—This soil has lost from one-third to two-thirds of its original surface layer through erosion. The present sur-

face layer has less desirable structure, is in poorer tilth, and is more susceptible to further erosion than that of a comparable soil that is not eroded. Also, the rate of infiltration is slower. The slopes are mainly between 4 and 6 percent. On this gently sloping soil, runoff is rapid enough to cause further erosion if this soil is not protected. Included in mapped areas of this soil are small areas of Tell silt loam, 2 to 6 percent slopes, and of Tell silt loam, 6 to 12 percent slopes, moderately eroded.

Protection is needed from further erosion. If contour stripcropping is practiced, a suitable cropping system is one consisting of 2 years of row crops, 1 year of a small grain, and 2 years of meadow. Such a cropping system adequately controls erosion and also conserves water. (Capability unit IIe-2, woodland suitability group 1)

Terrace Escarpments

Terrace escarpments consist of long, narrow, steep or very steep miscellaneous land types along the edges of stream terraces. The texture of the soil material near the surface ranges from sandy to silty. The underlying soil material varies both in depth and in characteristics. These land types are highly susceptible to serious gully erosion. They are not suitable for cultivation and are difficult to use and manage.

Terrace escarpments, loamy (Tl).—This land type consists of soil material that has a texture of loam or silt loam. It includes areas of Rozetta, Fayette, and Dakota soils that are too limited in extent or too variable in characteristics to be mapped separately. The slopes range from 12 to 45 percent. The available moisture capacity and natural fertility are moderate.

The steep slopes and severe hazard of erosion make this land type unsuitable for field crops. The areas that are not too steep for operating farm machinery can be used for pasture, and yields of forage are generally good. The steeper areas are suitable for permanent grass or trees. Good yields of timber are obtained on the slopes that face north and east, but the yields are lower on the slopes that face south and west. The wooded areas need protection from fire and grazing. (Capability unit VIIe-1, woodland suitability group 1)

Terrace escarpments, sandy (Ts).—This is a steep land type that occurs in narrow bands on the edges of stream terraces. It consists of sandy material typical of such soils as the Plainfield, Sparta, Burkhardt, and Dakota. The areas mapped include small patches of these soils that are too variable in characteristics or too limited in extent to be mapped separately. The slopes range from 12 to 45 percent.

This land type has low available moisture capacity and is susceptible to severe erosion. It is not suitable for cultivation but can be used for permanent vegetation, such as pasture or trees. It can also be used to provide food and cover for wildlife. Pasture is the main use. Careful control of grazing is needed in the pastured areas, however, to help to control erosion. If erosion is not controlled, cropland on the adjacent lower lying terraces can be seriously damaged.

Pine trees grow well on this land type. Where hardwoods are grown, yields of timber are rather low because of the limited available moisture capacity. (Capability unit VIIs-9, woodland suitability group 4)

Terril Series

The Terril series consists of deep soils that are well drained or moderately well drained. These soils occur throughout the county, along the courses of streams and on the flood plains of the larger streams. They have formed in loamy sediments washed from dark-colored soils developed under prairie grasses on the uplands.

Representative profile of Terril loam:

0 to 34 inches, very dark brown, friable loam.
34 to 45 inches, very dark brown, firm silt loam.
45 inches +, dark-brown, firm heavy loam.

The Terril soils are moderately permeable and have high available moisture capacity. Their root zone is not restricted. These soils are fertile, but good response is received from applications of fertilizer. They are medium acid.

Terril loam (0 to 3 percent slopes) (Tx).—This is the only Terril soil mapped in Pierce County. It is easy to till because it is nearly level and has a deep, friable surface layer. Many of the areas are subject to overflow, but flooding does not limit the use of this soil for agriculture. Natural fertility is high.

This soil can be cropped intensively if it is well managed, and if lime and the proper kinds and amounts of fertilizer are applied. Where flooding and streambank cutting are continuing hazards, forage crops can be grown for hay or pasture, or this soil should be used for trees or for areas that provide food and cover for wildlife. (Capability unit IIw-11, woodland suitability group 12)

Vlasaty Series

The Vlasaty series consists of moderately well drained soils that are gently sloping or sloping. These soils have formed in 12 to 30 inches of windblown silt (loess) over glacial till. They are on uplands in the northern half of the county.

Representative profile of a cultivated Vlasaty silt loam:

0 to 8 inches, dark-gray, friable silt loam.
8 to 12 inches, brown, very friable silt loam; few, fine, yellowish-brown mottles.
12 to 16 inches, dark yellowish-brown, plastic silty clay loam; many, faint, yellowish-brown mottles.
16 to 42 inches, dark yellowish-brown, plastic clay loam; many, fine, grayish-brown mottles.
42 to 58 inches +, yellowish-brown to grayish-brown, plastic clay loam.

The Vlasaty soils are moderately permeable, have slow internal drainage, and have high available moisture capacity. In areas that have been limed, the reaction of the surface layer is neutral, but these soils are medium acid to very strongly acid in other areas. The depth to which roots can penetrate is not restricted. Natural fertility is moderate, but lime is generally needed. After lime has been added, good response is generally received from fertilizer. In Pierce County these soils are well suited to all of the locally grown crops and are important for agriculture.

Vlasaty silt loam, 2 to 6 percent slopes (VaB).—This is a gently sloping soil on broad uplands. It occupies areas slightly lower in the soil pattern than those occupied by the Renova soils. The profile is the one described for the series. The slopes are concave.

This soil is productive and is desirable for crops. It is used for field crops where the slopes are no stronger than 4 percent and where erosion has not been a problem. Nevertheless, almost all of the acreage is in permanent pasture or trees.

Although runoff is rather slow, erosion is a slight hazard. Only simple practices are needed, however, to protect cultivated areas of this soil. Row crops can be grown 2 years out of 5 where stripcropping is practiced. If the fields are terraced, a more intensive cropping system can be used. (Capability unit IIe–1, woodland suitability group 1)

Vlasaty silt loam, 2 to 6 percent slopes, moderately eroded (VaB2).—This is a gently sloping soil on broad uplands. It has been cultivated, and in most places it has lost from one-third to two-thirds of its original surface layer through erosion. In some spots, however, the subsoil is exposed. The present surface layer is generally grayish brown, but it is dark brown in the areas where the subsoil is exposed. The present surface layer has a lighter color, contains less organic matter, and is in poorer tilth than that of a comparable soil that is not eroded. It is generally 6 to 8 inches thick.

This soil is slightly susceptible to further erosion. It can be kept in good tilth, however, by using the rather simple practices to control erosion and conserve water that are suggested for Vlasaty silt loam, 2 to 6 percent slopes. (Capability unit IIe–1, woodland suitability group 1)

Vlasaty silt loam, 6 to 12 percent slopes (VaC).—This is a sloping soil of the uplands. It has been used mainly as woodland or for pasture. Little erosion has taken place, and the surface layer is about 8 to 10 inches thick in most places. The profile is slightly thinner than the profile described for the series.

The hazard of erosion is moderate, but row crops can be grown if practices are used to protect this soil. If contour stripcropping is practiced, row crops can be grown 1 year out of 5. (Capability unit IIIe–1, woodland suitability group 1)

Vlasaty silt loam, 6 to 12 percent slopes, moderately eroded (VaC2).—This is a sloping soil of the uplands. It has been cultivated. In most places from one-third to two-thirds of the original surface layer has been lost through erosion. In some areas, however, the subsoil has been exposed by tillage. The present surface layer is generally 4 to 8 inches thick. It is lower in content of organic matter and is in poorer tilth than the original one. The loss of organic matter and poorer tilth, in turn, increase the risk of further erosion. The present surface layer is lighter colored and thinner than the one in the profile described for the series, and the profile is less deep over glacial till. In some spots where tillage has exposed the subsoil, the present surface layer is dark brown.

The hazard of further erosion is moderate, but row crops can be grown if practices are used to protect this soil. Where contour stripcropping is practiced, row crops can be grown 1 year out of 5. (Capability unit IIIe–1, woodland suitability group 1)

Waukegan Series

The Waukegan series consists of moderately deep, silty, nearly level or gently sloping soils that are well drained. These soils are on stream terraces, where they are underlain by sand at some depth between 24 and 38 inches. They occur mainly in the northwestern part of the county between the towns of Prescott and River Falls. To a lesser extent, they occur on a terrace on the Mississippi River between Bay City and Diamond Bluff. Smaller areas occupy stream terraces throughout the county.

Representative profile of a cultivated Waukegan silt loam:

0 to 7 inches, black, very friable silt loam.
7 to 15 inches, very dark brown, friable silt loam.
15 to 28 inches, dark-brown, friable silt loam.
28 to 34 inches, dark-brown, friable sandy loam.
34 to 60 inches +, yellowish-brown, loose fine sand.

The Waukegan soils have moderate permeability, rapid internal drainage, and moderate moisture-supplying capacity. Rainfall must be well distributed throughout the growing season, and good management is necessary for moderately high yields. Natural fertility is high, but good response is obtained from applications of fertilizer.

Before these soils were cultivated, the content of organic matter was very high, but it has been greatly depleted by intensive farming. These soils still contain more organic matter, however, than a comparable light-colored soil.

In areas where these soils have been limed, the surface layer has a neutral reaction, but the reaction is medium acid in other areas. The root zone of most crops extends to the sandy substratum, but larger roots penetrate deeper. Management practices that conserve water are needed. Locally, these soils are important for farming.

Waukegan silt loam, 0 to 2 percent slopes (WaA).—In most places the profile of this soil is like the profile described for the series, but it is thicker in places. In the areas where the profile is thicker, the surface layer is slightly thicker than the one in the profile described for the series. Also in those areas, the subsoil of silt loam or loam extends to a depth as great as 42 inches.

This nearly level soil is not eroded or is only slightly eroded. No special practices are needed to protect it from erosion. If an adequate supply of plant nutrients and the content of organic matter are maintained clean-tilled crops can be grown fairly intensively. During prolonged periods of dry weather, however, crops grown on this soil are damaged from lack of moisture sooner than crops grown on soils that contain deeper layers of material that hold water well. (Capability unit IIs–1, woodland suitability group 12)

Waukegan silt loam, 2 to 6 percent slopes (WaB).—This is a gently sloping soil that has a profile similar to the one described for the series. It is only slightly eroded. Included in the areas mapped are small areas of Waukegan silt loam, 2 to 6 percent slopes, moderately eroded.

Runoff is not excessive, but some practices are needed to control erosion. In some places erosion can be controlled by using a suitable cropping system. In others

terracing, stripcropping, or other supporting practices are needed. If erosion is controlled, and if this soil is otherwise well managed, farming can be fairly intensive. Good yields of crops are generally obtained. During seasons when the amount of rainfall is small, or when the rainfall is poorly distributed, crops are damaged by drought sooner than those grown on soils that contain deeper layers that hold water well. (Capability unit IIe–2, woodland suitability group 12)

Whalan Series

The Whalan series consists of well-drained soils of the uplands. These soils have formed in more than 20 inches of silty loess and glacial till over a thin layer of material weathered from limestone. They are underlain by fissured dolomite. These soils are most extensive in the northern half of the county. They range from nearly level to steep.

Representative profile of Whalan silt loam that has not been cultivated:

0 to 10 inches, very dark grayish-brown, friable silt loam.
10 to 27 inches, dark-brown, firm silty clay loam.
27 to 29 inches, dark-brown, firm sandy clay loam.
29 inches +, yellowish-brown, fissured dolomite.

The Whalan soils are moderately permeable and have moderate available moisture capacity. Reaction is neutral to medium acid. The depth to which roots can penetrate is restricted by the underlying bedrock. Natural fertility is moderately high, but good response is obtained from applications of fertilizer.

These soils are important for farming. Crops grown on them have potential for moderately high yields.

Whalan silt loam, 0 to 2 percent slopes (WhA).—This soil occupies a small acreage on limestone-capped uplands and on limestone terraces along the Rush River. Its profile is similar to the profile described for the series. On the rock-formed terraces, however, limestone bedrock is generally at a depth of 30 to 42 inches and the layer of sandy clay loam is comparatively thin.

This nearly level soil has been cultivated, but no noticeable erosion has taken place. Surface runoff is very slow, and practices are not needed to control erosion. If an adequate supply of plant nutrients is maintained, and if crop residue is returned to the soil, crops can be grown intensively. (Capability unit IIs–1, woodland suitability group 1)

Whalan silt loam, 2 to 6 percent slopes (WhB).—This is a gently sloping soil on upland ridgetops and on limestone terraces. It is mainly on narrow ridgetops, on the ends of ridges, or in other areas that are not well suited to cultivation or that are not accessible. Most of the areas are wooded, but some areas are cultivated. In the areas that are cultivated, the slopes are generally less than 4 percent and erosion has not been a problem. The profile in cultivated areas of this soil is generally deeper over limestone bedrock than the profile described for the series. Leaf litter provides protection from erosion in the wooded areas.

Yields of cultivated crops grown on this soil are potentially high. Lime and fertilizer are necessary, however, and they should be applied according to the needs indicated by the results of soil tests and the requirements of the crop to be grown. Erosion is a slight hazard, but a fairly intensive cropping system can be safely used if simple practices are applied that control erosion. The wooded areas need protection from fire and grazing. (Capability unit IIe–2, woodland suitability group 1)

Whalan silt loam, 2 to 6 percent slopes, moderately eroded (WhB2).—This is a gently sloping soil on the rounded tops of ridges and on rock-formed terraces. It has lost from one-third to two-thirds of its original surface layer through erosion, and the present surface layer is 4 to 8 inches thick. The soil material in the remaining surface layer has been mixed by tillage and is dark grayish brown or very dark grayish brown. The profile is similar to the one described for the series, except for the lighter color of the surface layer.

If this soil is properly managed, it is highly productive and is well suited to row crops, small grains, and hay. Nearly all of the acreage is cultivated. Runoff is not excessive, but some practices are needed to prevent further erosion. Good response is obtained from applications of lime and fertilizer. (Capability unit IIe–2, woodland suitability group 1)

Whalan silt loam, 6 to 12 percent slopes (WhC).—This soil is on upland ridges and on limestone terraces in areas not well suited to tillage. Most of the areas are wooded or in pasture, and little or no erosion has taken place. The profile is the one described for the series.

The hazard of erosion is moderate, and practices are needed to control erosion if this soil is cultivated. On the very long slopes, row crops can be included in the cropping system if stripcropping is practiced. (Capability unit IIIe–2, woodland suitability group 1)

Whalan silt loam, 6 to 12 percent slopes, moderately eroded (WhC2).—This soil is on the side slopes of ridges. Tillage has mixed the material in the surface layer, and the present surface layer is dark grayish brown. In general, except for this lighter colored surface layer, the profile is similar to the one described for the series. In some areas, however, as much as two-thirds of the original surface layer has been lost through erosion and the present surface layer is 4 to 8 inches thick. Included in the mapped areas of this soil are small areas of Whalan silt loam, 6 to 12 percent slopes, severely eroded.

Crops that require cultivation are grown on nearly all areas of Whalan silt loam, 6 to 12 percent slopes, moderately eroded. The main crops are corn, oats, and an alfalfa-brome mixture. Good yields of these crops can be obtained if practices are used to help to control erosion, and if enough lime and fertilizer are applied. (Capability unit IIIe–2, woodland suitability group 1)

Whalan silt loam, 12 to 20 percent slopes (WhD).—Except that the layers are slightly thinner, the profile of this soil is similar to the profile described for the series. Depth to the layer of dark-brown, firm sandy clay loam ranges from 24 to 28 inches. This is a moderately steep soil, and much of the acreage is in trees. In the wooded areas, little or no erosion has taken place.

Because of the moderately steep slopes and the susceptibility to severe erosion, this soil must be managed carefully if it is cultivated. It is not suited to row crops. The most intensive cropping system that can be safely used is one that consists of small grains and meadow. Gullying is a hazard if runoff is allowed to concentrate.

Controlled grazing will help to maintain a cover of plants in the areas used for permanent pasture. The

wooded areas are well suited to trees and can be managed for sustained production of timber. (Capability unit IVe-2, woodland suitability group 1)

Whalan silt loam, 12 to 20 percent slopes, moderately eroded (WhD2).—The profile of this moderately steep soil is thinner over the layer of dark-brown, firm sandy clay loam than the profile described for the series. Depth to the layer of sandy clay loam is about 24 to 28 inches. From one-third to two-thirds of the original surface layer has been lost through erosion. The present surface layer is 4 to 6 inches thick and is dark grayish brown.

This soil is not suitable for intensive cultivation. Moderately high yields of small grains and hay can be obtained, however, if good management is used, and if practices are used that help to control erosion. A suitable cropping system is one that consists mainly of hay crops. Lime and fertilizer should be applied in accordance with the needs indicated by the results of soil tests and the needs of the crop to be grown. (Capability unit IVe-2, woodland suitability group 1)

Whalan silt loam, 12 to 20 percent slopes, severely eroded (WhD3).—The surface layer of this soil is thinner than the one in the profile described for the series. Also, the layer of dark-brown sandy clay loam is at a depth of only about 24 inches. More than two-thirds of the original surface layer has been lost through erosion, and the dark-brown subsoil has been exposed by tillage in much of the acreage. As a result, the rate of infiltration and the content of organic matter are lower than they were before this soil was eroded and good tilth is more difficult to maintain. The spots where the subsoil are exposed are more susceptible to further erosion than areas of a comparable uneroded soil.

Most areas of this moderately steep soil have been used for crops. Because of the severe erosion, however, many areas are now used for hay or they have been converted to pasture. This soil is suitable for renovated pasture or for other uses for which sod-forming crops are required. (Capability unit VIe-2, woodland suitability group 1)

Whalan silt loam, 20 to 30 percent slopes (WhE).—This is a steep soil on the side slopes of ridges in the uplands. Its profile contains slightly thinner layers and is normally shallower over bedrock than the one described for the series. Included in mapped areas of this soil are small areas of shallower Whalan soils. Limestone is exposed at the surface in some included areas.

Whalan silt loam, 20 to 30 percent slopes, is susceptible to very severe erosion. It is suited to forage crops grown for hay or pasture, or it can be used as woodland or to provide food and shelter for wildlife. Controlled grazing helps to maintain a good cover of sod if this soil is used for pasture. (Capability unit VIe-2, woodland suitability group 1)

Whalan silt loam, 20 to 30 percent slopes, moderately eroded (WhE2).—Like Whalan silt loam, 20 to 30 percent slopes, this soil is on the side slopes of upland ridges. Its profile is similar to the one described for the series, but in most places from one-third to two-thirds of the original layer has been lost through erosion. Spots of the dark-brown subsoil are exposed in the areas that are still cultivated or that have been intensively grazed. The present surface layer is lighter colored than the one in the profile described for the series. Included in the areas mapped are a few acres of Whalan silt loam, 20 to 30 percent slopes.

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Whalan silt loam, 20 to 30 percent slopes, moderately eroded, has about the same limitations and requires about the same management as Whalan silt loam, 20 to 30 percent slopes, and it is suited to about the same crops grown for hay or pasture. Practices that control erosion are important to protect this soil from losing additional soil material. (Capability unit VIe-2, woodland suitability group 1)

Worthen Series

Deep, dark-colored, well drained or moderately well drained soils make up the Worthen series. These soils have formed in deep deposits of silty material that has been moved down by water or by gravity from the steeper slopes above. They are widely distributed throughout the county. These soils occupy small areas, mainly in narrow valleys, at the heads of draws, on bottoms along small, intermittent streams, and at the foot of steep slopes. They are nearly level to sloping, but most of the slopes are less than 6 percent.

Representative profile of a cultivated Worthen silt loam:

0 to 16 inches, very dark brown, very friable silt loam.
16 to 27 inches, very dark grayish-brown, friable silt loam.
27 inches +, dark grayish-brown, friable silt loam.

Runoff is medium, and the Worthen soils have moderate permeability and high available moisture capacity. The reaction is neutral to strongly acid. The root zone is deep, and these soils have high natural fertility and a high content of organic matter. Their thick, friable surface layer makes them highly desirable for farming.

Worthen silt loam (0 to 3 percent slopes) (Wn).—This is the only Worthen soil mapped in Pierce County. It is adjacent to intermittent streams and is subject to occasional flooding. In places the floodwaters deposit a thin layer of sand and a few small stones on the surface. The soil is nearly level or gently sloping. Its profile is the one described for the series.

This soil is well suited to all the crops commonly grown in the county including such special crops as peas, potatoes, and green beans. It can be cropped intensively, and good yields can be obtained if management is good. The small areas in which a layer of sandy overwash covers the surface are generally managed like other areas of this soil.

If this soil is cropped intensively, the supply of plant nutrients is reduced and manure and a commercial fertilizer are needed. Areas likely to be damaged by flooding can be protected by installing dikes, diversions, or waterways, or they can be kept in hay or pasture. Forage crops respond well if a complete fertilizer is applied periodically. (Capability unit I-1, woodland suitability group 12)

Wykoff Series

The Wykoff series consists of soils that are well drained and that are moderately shallow over glacial till. These soils have formed on upland glacial till plains in a mantle of silty loess over stratified glacial till. They are gently sloping to moderately steep.

Representative profile of a cultivated Wykoff loam:

0 to 9 inches, dark grayish-brown, friable loam.
9 to 15 inches, dark-brown, firm loam.
15 to 23 inches, dark-brown, firm gravelly loam.
23 to 30 inches, reddish-brown, friable gravelly sandy loam.
30 to 42 inches +, dark-brown, loose, layered sandy loam and gravelly loam.

The Wykoff soils have moderate permeability, rapid internal drainage, and moderate available moisture capacity. They are slightly droughty during extended dry periods. These soils are slightly acid to medium acid. Natural fertility is moderate.

Wykoff loam, 2 to 6 percent slopes (WoB).—This soil occupies convex slopes in broad areas of the uplands. The areas that are not susceptible to erosion have been cultivated, and the other areas have been kept in permanent pasture or trees. Because this soil is not eroded, its surface layer is generally a few inches thicker than the one in the profile described for the series.

Although erosion is a slight hazard, runoff is rather slow. This soil is only slightly droughty. Only simple practices are needed to control erosion in areas that are cultivated. Contour stripcropping is suggested, for this practice conserves water as well as controls erosion. If contour stripcropping is practiced, row crops can be grown 2 years out of 5. Where the fields are terraced, a more intensive cropping system may be used. (Capability unit IIe–2, woodland suitability group 5)

Wykoff loam, 2 to 6 percent slopes, moderately eroded (WoB2).—This soil, like Wykoff loam, 2 to 6 percent slopes, occupies broad areas in the uplands, where the slopes are convex. All of the acreage has been cultivated. As a result, this soil has lost from one-third to two-thirds of its original surface layer through erosion. In general, the present surface layer is lighter colored, contains less organic matter, and is in poorer tilth than the original one. In a few spots, the dark-brown subsoil is exposed. The profile of this soil is the one described for the series.

Erosion has slowed the rate of infiltration and has made this soil slightly more susceptible to erosion and more droughty than a comparable soil that is not eroded. The same practices that are suggested for Wykoff loam, 2 to 6 percent slopes, are needed for this soil to maintain good tilth and to obtain higher yields. (Capability unit IIe–2, woodland suitability group 5)

Wykoff loam, 6 to 12 percent slopes (WoC).—This is a sloping soil of the uplands. It has been used mainly as woodland or for pasture. As a result, little or no erosion has taken place and the surface layer is about 8 to 10 inches thick in most places. The profile is similar to the one described for the series, except that it is less deep over sandy and gravelly loam and it has retained most of its original surface layer.

This soil is moderately susceptible to erosion, and it is also slightly droughty. If row crops are grown, practices are needed that control erosion. Row crops may be grown 1 year out of 4 if stripcropping is practiced. (Capability unit IIIe–2, woodland suitability group 5)

Wykoff loam, 6 to 12 percent slopes, moderately eroded (WoC2).—This is a sloping upland soil that has been cultivated. In most places from one-third to two-thirds of the original surface layer has been lost through erosion and the present surface layer is generally only 4 to 8 inches thick. In some spots, however, tillage has removed all of the original surface layer. In those areas the present surface layer consists of dark-brown soil material that was formerly part of the subsoil. The present surface layer contains less organic matter than the original one. The profile is less deep over sandy and gravelly loam and has a thinner surface layer than the profile described for the series.

The lower content of organic matter and the poorer tilth make this soil more susceptible to erosion than Wykoff loam, 6 to 12 percent slopes. The hazard of further erosion is moderate, but row crops can be grown occasionally if practices are used to protect this soil. If contour stripcropping is practiced, row crops can be grown 1 year out of 5. (Capability unit IIIe–2, woodland suitability group 5)

Wykoff loam, 6 to 12 percent slopes, severely eroded (WoC3).—This soil has been cropped intensively and has lost more than two-thirds of its original surface layer through erosion. In much of the acreage where this soil is still cultivated, the subsoil is exposed. The present surface layer is dominantly dark brown. It is low in content of organic matter and is hard to keep in good tilth. The rate of water infiltration is slower, the amount of runoff is greater, and the surface layer is more gravelly and cobbly than in areas that are less eroded.

The hazard of further erosion is moderate to severe. Large applications of barnyard manure and commercial fertilizer are needed to build up the supply of plant nutrients, to improve tilth, and to increase the rate of infiltration. This soil is more susceptible to further erosion than is a comparable uneroded soil. Therefore, control of erosion is important. (Capability unit IVe–2, woodland suitability group 5)

Wykoff loam, 12 to 20 percent slopes (WoD).—Most areas of this soil are wooded and are not noticeably eroded. The slopes are convex and are moderately steep. The profile is generally shallower over the sandy and gravelly drift than the profile described for the series. Also, the surface layer is thinner, or 4 to 8 inches thick.

Wooded areas of this soil are protected by a permanent cover of plants, and there is no serious hazard of erosion. In the areas used for pasture, a firm sod can be maintained by controlling erosion. In the wooded areas, sustained production of timber is feasible if the areas are protected from fire and grazing. (Capability unit IVe–2, woodland suitability group 5)

Wykoff loam, 12 to 20 percent slopes, moderately eroded (WoD2).—This soil has been cultivated and has lost from one-third to two-thirds of its original surface layer through erosion. The present surface layer has a brownish color, because tillage has mixed part of the subsoil with the surface soil. It contains less organic matter and is in poorer tilth than the original one. This soil occurs at a slightly lower elevation in the soil pattern than the Wykoff and Renova soils that are less sloping. It is at a higher elevation than the Whalan soils that are steeper. The profile is shallower over sandy and gravelly material than the profile described for the series, and the surface layer is 4 to 8 inches thick. Included in the mapped areas of this soil are small areas of Wykoff silt loam.

Wykoff loam, 12 to 20 percent slopes, moderately eroded, is susceptible to severe water erosion. It can be used to grow forage crops or in a cropping system no

more intensive than 1 year of a small grain followed by 3 years of meadow. In the pastured areas, controlling grazing helps to maintain a firm sod that resists erosion. The risk of gully erosion can be decreased by discouraging cattle from making trails where runoff can concentrate. (Capability unit IVe–2, woodland suitability group 5)

Wykoff loam, 12 to 20 percent slopes, severely eroded (WoD3).—This is a moderately steep soil that has been cultivated. It has lost more than two-thirds of its original surface layer through erosion. The present surface layer consists mainly of dark-brown material from the subsoil, and it is less than 4 inches thick. It is low in content of organic matter and is in poorer tilth than the original one. In places small areas of glacial drift are exposed. The surface layer is gravelly and cobbly in some places.

This soil is low in content of organic matter and is difficult to keep in good tilth. The rate of water infiltration is slow. Runoff is extensive, and the hazard of further erosion is severe. Gullying is difficult to control in the drainageways.

This soil can be used to produce forage for hay or pasture, or it can be planted to trees. Large amounts of barnyard manure and of commercial fertilizer are needed. (Capability unit VIe–2, woodland suitability group 5)

Wykoff silt loam, 2 to 6 percent slopes (WsB).—This soil occupies broad areas in the uplands. It is a productive soil and is desirable for crops. Some areas are in permanent pasture or trees. Others, where the slopes are less than 4 percent and where erosion has not been a problem, are used for crops.

Erosion is a slight hazard on this gently sloping soil, but runoff is rather slow. Only simple practices are needed to control erosion in the cultivated areas. Row crops can be grown 2 years out of 5 if stripcropping is practiced. If the fields are terraced, a more intense cropping system may be used. (Capability unit IIe–2, woodland suitability group 5)

Wykoff silt loam, 2 to 6 percent slopes, moderately eroded (WsB2).—This soil is in broad areas in the uplands. It has been cultivated and in most places has lost from one-third to two-thirds of its original surface layer through erosion. The present surface layer is 6 to 8 inches thick. In most places it is grayish brown, but it is dark brown in some spots where the subsoil is exposed. The content of organic matter is low, and tilth is poorer than in the original surface layer. Also, the rate of infiltration is slower.

The slower rate of infiltration makes this soil a little more susceptible to erosion than Wykoff loam, 2 to 6 percent slopes, although the hazard of further erosion is slight. Fairly simple practices that control erosion are needed to keep this soil in good tilth. These practices should also conserve water. (Capability unit IIe–2, woodland suitability group 5)

Wykoff silt loam, 6 to 12 percent slopes, eroded (WsC2).—This soil has been cultivated and has lost from one-third to two-thirds of its original surface layer through erosion. The present surface layer is lighter colored, is in poorer tilth, and has a lower content of organic matter than a comparable Wykoff silt loam that is not eroded. The profile of this soil is like the one described for the series, except that the texture of the surface layer is silt loam.

This soil is moderately susceptible to erosion, and it is slightly droughty. It is suitable for row crops if practices are used that control erosion. Contour stripcropping is the preferred practice because it conserves water and also controls erosion. (Capability unit IIIe–2, woodland suitability group 5)

Genesis, Morphology, and Classification of Soils[5]

In this section the factors of soil formation, the morphology and composition of the soils, and the classification of the soils into higher categories are discussed. Following these discussions, each soil series in the county is described, and a soil profile typical of the series is given. The information given is technical and is intended primarily for soil scientists and others who want more detailed information about the characteristics and origins of the soils of Pierce County than is given in the section "Descriptions of the Soils."

Factors of Soil Formation

The soils of Pierce County, like the soils of any other area, are the product of the action of climate and living organisms upon the parent material, as conditioned by local factors of relief. The magnitude of the combined influences of these four factors is, of course, a function of time.

Climate and living organisms are regarded as the active, or dynamic, agents of soil formation that supply the energy for the alteration of unconsolidated rock materials. Parent material, relief, and time are generally regarded as passive agents in this process. All five of these factors come into play in the genesis of every soil. In extreme cases one factor may dominate in the formation of a soil and fix most of its properties. In general, however, the influence of each of these factors is merged with the influence of others. A soil in any one place represents the effects of all of these factors interacting.

Climate

Pierce County has a cool, moist-subhumid, continental climate typical of the climate in the north-central part of the United States. Facts about the temperature and about the amount and distribution of rainfall throughout the years are given in the section titled "Climate" near the back of this soil survey.

The most important direct effects of climate are the weathering of rocks and the alteration of the material from which soils form. The indirect effects, however, are likely to be equal to the direct effects, or of even greater significance. For example, in areas where a large amount of precipitation is received and the temperature is rather high, some soils have a higher content of clay than soils in areas where less precipitation is received and the temperature is lower. Another indirect action of climate consists of supplying energy and a suitable environment for organisms. This indirect action is of special significance, because it results in an increase in the content of organic

[5] By PAUL H. CARROLL, soil scientist, Soil Conservation Service, U.S. Department of Agriculture.

matter in the soils, and it increases the soil fertility. In this county the indirect influence of climate is manifest in such soils as the Sparta, Waukegan, and Port Byron, which formed under a dense growth of grass and have a thick surface layer fairly high in content of organic matter.

Plant and animal life

The biological factors in soil formation—plant and animal life—are concerned chiefly with the cover of plants and with the accumulation of organic matter from the remains of plants. Such microscopic plants as bacteria and fungi have an important role, and earthworms, rodents, and man also are regarded as important components of the biological factor. Two of the chief functions of plant and animal life consist of supplying organic matter for the soil and of translocating plant nutrients from the lower to the upper horizons.

Before the area that is now Pierce County was settled, the native vegetation was the most important factor in the complex of living organisms that affect development of a soil profile. The first settlers found a dense stand of hardwoods and conifers in the eastern part of the county. They found mainly grass vegetation in the undulating or rolling areas in the northwestern part. In the western part of the county, especially in Oak Grove and Diamond Bluff Townships, they found both types of vegetation. The soils that have formed under forest have a thin, organic-mineral surface layer; contain a grayish-brown, leached layer; and contain a brown illuvial B horizon. Variants of these soils have also formed under forest. Farther west, the soils have formed under a cover of grass. The soils that formed under grass have an acid, thick, very dark brown or black A horizon that contains a large amount of organic matter; a brown B horizon that is mottled in some places and lacks mottling in other places; and a substratum that is lighter colored than the surface layer and subsoil and that is at a depth of 2 to 5 feet.

The climatic factor offers an adequate explanation of the podzolic processes that prevail or that have prevailed in the eastern part of the county, but it does not explain the lack of trees in the western part. Among the suggestions that have been offered to explain the lack of trees and the prevalence of grass in the western part of the county are such diverse factors as the peculiarities of the soils, dampness, dryness, excessive evaporation, fire, characteristics or nearness to the surface of the underlying rock, and local topography. Most of these explanations fall short of providing a complete answer, however, for the soils have formed under grass in loessal, glacial, or alluvial material; on ridges and in valleys; on moist as well as on dry sites; and over both acid and calcareous material. The modern consensus is centered around the belief that two distinct biotic factors have caused the prairies of the county. The first is that grazing buffalo destroyed the tree seedlings as rapidly as they were produced. The other is that repeated grass fires, spreading from Indian camps and villages or purposely set to flush out wild game, destroyed the tree seedlings as rapidly as they were produced.

An outstanding example of the influence of vegetation on the characteristics of a soil may be seen in the contrast between the profiles of dark-colored soils that formed under grass and light-colored soils that formed under trees. The two main groups of soils in Pierce County are those that have characteristics of soils that formed entirely under grass, and those that have characteristics of soils that formed entirely under forest. Even though these two different kinds of soils may have formed in the same kind of mineral material, the presence of trees in some areas and of grass in others has resulted in different kinds of soils.

The difference in the amount of organic matter in soils formed under grass and in soils formed under forest is ascribed partly to the fact that soils that formed under forest generally have a more acid reaction than those formed under grass. The organic matter from grass is much less acid, is less soluble in water, and is more stable than that formed from forest litter (*5*). In places where the vegetation consists of a mixture of trees and grasses, the characteristics of the soils are intermediate between those of soils formed under prairie and those of soils formed under forest (fig. 14).

In areas of the county that have been cultivated over a long period of time, man, as a component of the biological factor, has brought about much change in the original soils. He has altered the reaction and fertility of acid soils by adding lime; has burned over wooded sites and has thus perpetuated a grassland type of vegetation in areas that are normally wooded; has caused losses of organic matter by improper cropping and tillage practices; and has accelerated erosion by persistently removing the cover of plants on terraces, upland fields, and other sloping areas. Examples of soils formed largely as the result of accelerated erosion are those of the Arenzville series. The Arenzville soils have formed in silty material washed from soils of terraces or uplands and deposited over wet, dark-colored recent alluvium on the flood plains of streams.

Man often causes changes in the soils by making vegetation a variable that is independent from other factors. Within the same general area, he may, for instance, plant different kinds of crops on soils of the same or of similar kind. For example, he may use one tract of land for permanent pasture and an adjacent tract for row crops, although the soils in the two tracts are of the same kind. Differences in fertility, content of organic matter, or other soil characteristics of the soils of these two tracts may be attributed, in large part, to man's influence in directing or controlling the growth of selected plants.

Man undoubtedly will make other contributions to the future direction and rate of development of soils in the county. The continued clearing of woodland, the cultivation of the soils, the introduction of new species of plants, the building of structures to control water, and the artificial improvement of natural drainage will all be reflected in the kinds of soils that are formed and in the rate of soil genesis in the future. Some of these changes may not be evident for centuries.

Parent material

Many of the soils of this county were derived from loess, but some soils were derived, wholly or in part, from glacial till; from the products that resulted from the weathering of the underlying limestone, shale, and sandstone; and from material that washed down from slopes and was transported by streams and deposited as terrace

Figure 14.—**An area called an oak opening, where a semiprairie type of vegetation is prevalent. Soils that have formed in such an area have characteristics both of soils formed under grass and of soils formed under forest. This kind of mixed vegetation was dominant in the western part of the country before the first settlers arrived.**

formations and as bottom lands. Part of the material deposited on stream bottoms and terraces probably originated as glaciofluvial material. It may have originated from glacial drift in areas outside as well as inside the county.

The soils of the county show a heterogeneity of characteristics that reflect certain differences related to the overburden of loess and the underlying geological material. The underlying material is divided rather unevenly among glacial drift, alluvium, and material weathered from bedrock. The drift is most extensive in its influence on the formation of soils. The influence of these geologic deposits and formations on the development of soils is determined by their physical and mineralogical composition. For example, some rocks from which material has weathered to form soils are consolidated and others are unconsolidated. Some are coarse textured, and others are fine textured. Some are covered by a deep mantle of loess, and others have lost their mantle of loess through erosion. Some, such as the dolomitic rocks, are resistant to change; others, such as the sandstones, are subject to rapid disintegration under the prevailing environment. Most of the materials in which the soils formed are mineral in composition, but a few are organic. Differences in the kind of material in which the soils have formed play an important part in the kinds of soils that occur in an area.

Loess covers most of the county to a depth ranging from 32 to about 100 inches. It is wholly or in part the parent material of most of the soils. On the loess-covered uplands occur rather extensive areas of Seaton and Downs soils. Where till underlies the loess at a depth between 32 and 60 inches, Otterholt and similar soils have formed. In areas where the mantle of loess is thinner over the till, the parent material is two storied and

such soils as the Santiago, Renova, Ostrander, and their catenary associates[6] have formed.

Peripheral to the areas of deeper loessal soils that are centrally located on the uplands, and that are generally adjacent to the marginal breaks occupied by Steep stony and rocky land, are areas of Gale and Dubuque soils. The soils of both of these series have formed in a moderately deep mantle of loess. The Gale soils, however, are underlain by sandstone, and the lower part of their solum developed in material weathered from sandstone. The Dubuque soils are underlain by fissured dolomite, and the lower part of their solum developed in material weathered from the dolomite. Beyond the outer boundaries of areas of these soils, the mantle of loess continues to thin out on the steeper slopes. In the areas along streams, where accelerated erosion has taken place, such soils as the Sogn are predominant. The Sogn soils are steep and are shallow over dolomite.

Many of the soils of the county have originated in material weathered from exposed bedrock. The county is situated on a dissected cuesta made up of four rock formations consisting of sandstone and dolomite. The layers of resistant dolomite alternate with those of two less resistant formations of sandstone. Each of these four formations provides the material from which the soils of one or more series in the county were derived.

At one time, the upper capping of dolomite may have formed a continuous surface formation in this county. After geologic erosion took place, however, the dolomite was probably deeply dissected, and part of it wore away. Now, dolomite occurs only as remnants that cap the higher hills and ridges in the northwestern part of the county, near Ellsworth and north of that city. In most places it underlies a shallow, loess-mantled layer of bluish-gray, plastic shale in which the lower part of the solum of the Derinda soils has formed.

The sandstone in Pierce County consists almost entirely of pure silica. It contains few weatherable minerals that are favorable to the development of soils. Unless the sandstone has been mixed with loess or by other foreign material, distinct illuvial horizons have not developed. The Hixton, Hesch, and Boone soils have formed in material weathered from the sandstone. The largest areas of these soils occur in the northwestern quarter of the county, near to and north of Lawton.

Basal to the sandstone in the upper reaches of the watershed of Plum Creek is a small driftless area of extremely acid shale bedrock covered by a mantle of loess. In this area the acid variants of the Derinda soils occur. The lower part of their solum has developed in material weathered from the shale, and these soils reflect the extremely acid reaction of the shale.

Although loess, till, and material weathered from bedrock are the more common materials in which the soils of the county have formed, some of the soils have formed in glaciofluvial material or in alluvium. The material in which the soils of the terraces and of flood plains of the present streams occur was deposited originally as local alluvium washed from the uplands, or as glaciofluvial material from the adjacent areas covered by drift. Where the streams have built a succession of terraces in the valleys, the higher terraces represent the earlier deposits and the lower terraces represent the more recent ones. Among the soils that occupy these loess-mantled terraces are the Port Byron, Waukegan, Fayette, and Tell and their catenary associates.

Fairly extensive areas of silt-mantled terraces are in the northwestern part of the county, to the north and south of the Kinnickinnic River. Many of the older terraces have received no alluvial or colluvial deposits for centuries. The terraces at the lower levels, however, have formed more recently. The ones at the lowest levels may even now be receiving deposits as the result of periodic overflow. The more recently formed terraces occupy areas adjacent to the Mississippi River, between the towns of Diamond Bluff and Bay City. On these more recent and lower lying terraces occur such soils as the Sparta and Plainfield and their catenary associates, which all have poorly defined horizons.

The dominant areas of soils formed in alluvium are along the Mississippi, Eau Galle, Rush, and Trimbelle Rivers. In those places are soils of the Arenzville and Orion series and areas of the miscellaneous land type, Alluvial land.

Only one organic soil, Adrian muck, is mapped in this county. It occurs along the Trimbelle River and along the South Fork Kinnickinnic River. The material in which this organic soil formed consists primarily of the remains of sedges and grasses. These remains are decomposed to the extent that the parts of the plants are no longer recognizable.

Relief

Differences in the elevation and inequalities of the various land surfaces in the county are reflections of the influence of geological and hydrographic factors. For example, hills, valleys, and plains have resulted from the action of rains, rivers, glaciers, and wind, all acting throughout long periods of time. The dip of the surface rock formations affects the direction of the slopes and the movement of water. In general, the slope is southwesterly, and the fall is approximately 9 feet to the mile. The resistance or lack of resistance of the underlying rocks has determined where uplands would be left and where lowlands would be sculptured by the erosion caused by streams. Ice that has invaded has also acted to modify preglacial relief by eroding and depositing rocks and soil material.

Relief influences the formation of soils by controlling drainage and runoff. It also directly or indirectly influences erosion and other effects of water. In many places in Pierce County, the relative elevations or inequalities of the land surface can be correlated closely with the kind of drainage, with the thickness and content of organic matter of the A horizon, with the depth of the solum, and with the differentiation of horizons in the profile.

Drainage characteristics are generally reflected in the color of the soil profile and in the kind of mottling or gleying. For example, gently undulating or rolling, well-drained Seaton, Downs, Dubuque, Gale, and Hixton soils of the uplands have mottling similar to that of gently undulating or rolling, well-drained Fayette, Dakota, Port Byron, and Waukegan soils of stream terraces.

[6] Soils that occur with these soils and that formed in the same kind of material but have different characteristics because of differences in relief and drainage.

None of these soils have mottling in the A and B horizons, but they have mottling deep in the C horizon in places, or below a depth of several feet. In contrast, moderately well drained Rozetta soils and other nearly level or gently sloping soils of stream terraces have mottling in the lower part of the B horizons as well as in the C horizon. Somewhat poorly drained, nearly level Stronghurst and Lawler soils of the stream terraces, and nearly level or gently sloping, somewhat poorly drained soils, such as the Almena, Floyd, and Freer soils of the uplands, commonly have mottling below a depth of 6 to 16 inches in the lower part of the A and in the B and C horizons. The poorly drained or very poorly drained Clyde and Sable soils, in nearly level or concave areas, have a dark-colored organic-mineral surface layer of moderate thickness (generally more than 6 inches thick) underlain by mineral gley horizons.

In many places relief is related directly or indirectly to the content of organic matter and the thickness of the surface horizon. In the usual pattern of soils in Pierce County, as in many other places, soils that have a light-colored surface layer are on the steeper or convex slopes. The soils that have a darker, thicker surface layer are in less sloping or concave areas. Little water runs off of nearly level or gently sloping areas.

Improvement in the relationship between the soils and water creates a soil-moisture environment favorable for the increased growth of plants. Consequently, a greater amount of organic matter is deposited in the soils and more organic matter accumulates. If the amount of water is slightly increased, even though a continued favorable environment is provided in the soil for most micro-organisms, more vegetable matter is likely to be produced than can be decomposed readily by the micro-organisms. As a result, additional organic matter builds up. Where the slopes are concave, waterlogging occurs and hydrophytic conditions prevail. In these more moist areas, hydrophytic plants are dominant in the plant community, most decomposing micro-organisms disappear, and the soils become gleyed and have a black A horizon.

Relief also may be correlated with the depth of the solum and with the differentiation of horizons in the profile. The soil-relief sequence consists generally of immature, skeletal soils that are generally steep, and of less sloping, progressively deeper soils that have a more clayey subsoil. The relationship is well illustrated in the contrast between the Boone and Hixton soils. These soils have formed in the same kind of material. The Boone soils, however, have little profile development. They lack the textural and structural B horizon typical of the Hixton soils, which are deeper and less sloping.

Variations in relief have locally modified the microclimate of this county. The effects of this modification can be seen in such soils as the Boone, Sparta, and Plainfield, which lack definite genetic horizons. It is also evident in such soils as the Dubuque and Fayette, which have a thin, organic-mineral surface layer and contain a grayish-brown, leached layer and an illuvial B horizon.

Lack of a clearly expressed morphology may be attributed, in large part, to the fact that less water from effective rainfall is retained in steep than in gently sloping soils. In steep areas more of the water runs off and less penetrates the surface soil to supply moisture for the growth of plants, for the activities of microbes and other forms of life, and for the weathering that causes rocks to disintegrate. Because much of the water runs off of steep areas, instead of entering the soil, the biological, physical, and chemical agents of weathering are suppressed and the formation of a soil profile is slowed. In many places soils in which the development of a profile has been affected by microclimate occur close to other soils that also have been affected.

By its influence on climate, the aspect of the slopes likewise has an important effect on the development of soils. For example, where the slopes face south or west and receive the effects of sun and wind during the warmer part of the day, the surface is warmer and drier than where the slopes have a northerly exposure. Thus, the low humidity and warmer temperatures result in a more sparse growth of trees on slopes that face south and west than on slopes that face north and east. On the warmer, less humid, south-facing slopes, the lower humidity and warmer temperatures have helped to make the cover of vegetation dominantly grassy, or the cover consists of a sparse stand of trees.

Time, or age

Time is required by active agents of soil development for the formation of a soil. Some soils form rapidly, and others form slowly. It seems probable that the material in which the soils of Pierce County are now forming or have formed were deposited during and after the advance of the Wisconsin glaciers, the latest of which moved into the county about 11,000 years ago (*4*). The period probably represents the time at which soils began to form.

When the formation of soils began, the soil material we now speak of as the solum had characteristics identical to those we now see in the parent material. Even today, some soils in the county show little, if any, profile development, because of the recent deposition of the soil material. Among such immature soils are the Arenzville, Chaseburg, and Worthen. In these soils little horizon development has taken place, although layering may be evident. With the passage of time, these soils may go through successive stages of immaturity, maturity, and old age.

A soil is said to be mature when it has well-defined genetic horizons, and when it is nearly in equilibrium with its present environment. At that time, the soil-forming factors no longer effect changes in the soil material. It must be kept in mind, however, that not all of the components of a soil approach maturity at the same rate, nor do we have reliable methods of determining accurately when a soil is in equilibrium with its environment.

The ages of the original soils of high stream terraces in the county are difficult to determine. The reason for this is that ancient winds have covered the various-aged materials of the terraces and uplands with cappings of silt of similar age. The term "old alluvium" has been used to distinguish alluvial material of the higher lying terraces from the alluvium of the more youthful, lower lying terraces. Among the silty soils that have formed on terraces in the older alluvium are those of the Fayette, Rozetta, and Stronghurst series. Among the soils that have formed on the lower lying terraces in recent alluvium or in glaciofluvial deposits are those of the Sparta and Plainfield series.

Morphology and Composition

Soil morphology in Pierce County is generally expressed by prominent horizons within the solum. In some soils development is in the early stages and the horizons in the profile are faint or indistinct. For example, gently sloping, well-drained soils that formed in medium-textured or fine-textured material on the uplands generally have distinct horizons. In contrast, soils that formed in recent sandy alluvium or in unadulterated material weathered from sandstone have faint horizons or none at all. The differentiation of horizons in soils of the county is the result of the accumulation of organic matter, the leaching of carbonates and salts, the accumulation of silicate clay minerals, the reduction and transfer of iron, or of more than one of these processes.

In all but a few of the soils of Pierce County, some organic matter has accumulated in the uppermost layers to form an A1 horizon. Much of the organic matter is in the form of humus. The quantity is small in some soils but fairly large in others. Such soils as the Plainfield loamy sands have a faint, thin A1 horizon. Others, such as the Port Byron, Sparta, Dakota, and Waukegan, have a thick A1 horizon that is fairly high in content of organic matter.

Leaching of carbonates and salts has occurred in almost all of the soils of the county, although it has been of limited importance in the differentiation of horizons. The effects have been somewhat indirect in that the leaching has permitted the subsequent translocation of silicate clay minerals to take place in some soils. In most of the well-drained soils, carbonates and salts have been carried completely out of the profile. Even in the wettest soils, some leaching is indicated by the absence of carbonates and by the acid reaction. Leaching is slow in very wet soils, however, because the movement of water through the profile is slow. Leaching also has made little progress in removing the carbonates from certain Ostrander and associated soils in an area underlain by calcareous glacial till near and southeast of Prescott.

In most of the soils of the county, the accumulation of silicate clay minerals has contributed to the development of horizons. Nearly all of the soils in an advanced stage of development have illuvial horizons in which clay has accumulated. In some soils, for example the Downs silt loams, which are deep, mature loessal soils of the uplands, an accumulation of silicate clay is expressed in illuvial B horizons. These B horizons contain more total clay and more fine clay that the horizons either above or below. In some shallower loessal soils, such as the Santiago, Renova, Racine, Derinda, and Schapville, the B horizons have developed partly in the underlying till or shale. In those soils the horizons of illuviation may not contain more total clay than the C horizon, but they do contain more fine clay. All soils that have a blocky structure have clay films on the structural peds. The films occur as thin layers on the faces of the peds, with the long axis of the particles of clay parallel to the surface on which the clay is deposited. This translocated clay tends to fill the natural cracks of the soil, and it juts into crevices and openings left by the roots of plants and by animals or insects.

The Sparta, Plainfield, and other nearly structureless soils have a slight accumulation of silicate clay in their B horizons. Obviously, they cannot have clay films on the surfaces of the peds, however, because they have no peds that have discernible cleavage planes. The clay in the illuvial horizons of these soils generally occurs as coatings on the individual grains of sand and oriented with the surface of the grain. Occasional pores in these horizons persist long enough for weak, patchy clay films to form.

In the Otterholt, Spencer, and Almena soils, there is evidence of the formation of horizons where silicate clay has accumulated, but later those horizons were partly destroyed. This degradation or destruction of the B horizon, which apparently is in only its initial stages in these soils, has removed the clay films from the primary faces of the peds and has left behind bleached coatings of silt or sand. Bleached silt veins along the vertical and horizontal structural cleavage planes provide evidence of this action.

The reduction and transfer of iron has occurred in all of the very poorly drained, poorly drained, and somewhat poorly drained soils of the county. In these naturally wet soils, this process, called gleying, is of importance in the differentiation of horizons. It is most pronounced in the Sable, Clyde, and Auburndale soils and in the wet subsoil variants of the Schapville series.

The gray colors of the deeper horizons of the wet soils indicate the reduction of iron oxides. This reduction is commonly accompanied by some transfer of iron, which may be local or general in character. After the iron has been reduced, it is removed completely from some horizons, and it may even be leached from the soil profile. More commonly in Pierce County, the iron is moved a short distance. It then stops, either in the horizon of its origin or in a nearby horizon. Iron has been segregated in the deeper horizons of some of the soils, where it causes yellowish-red, strong-brown, or yellowish-brown mottling. Spots of black manganese are also common.

The differentiation of the A1 horizon from the deeper horizons in poorly drained soils is caused by the reduction and transfer of iron. Differentiation between horizons also results, in part, from the greater accumulation of organic matter in the surface layer.

Classification of Soils

The current system of soil classification was adopted for general use by the National Cooperative Soil Survey in 1965. This comprehensive system was needed because of the shortcomings of older systems that were apparent when soils were classified in foreign countries and for interpretations in new fields of use. It is under continual study (*2, 7*). Therefore, readers interested in developments of the system should search the latest literature available.

The current system consists of six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the criteria used as a basis for classification are soil properties that are observable or measurable. The properties are chosen so that soils of similar genesis, or mode of origin, are grouped together.

In the orders of the current classification, soils are grouped according to common properties that seem to be the result of the same kinds of processes, acting to about the same degree on soil material and forming horizons.

Each order is subdivided into suborders, primarily on the basis of physical or chemical properties that reflect degree of wetness, differences that are the result of differences in climate and vegetation, and extremes of texture. Each great group is defined within its respective suborder, according to the presence or absence of diagnostic horizons and the arrangement of those horizons. Subgroups can be defined only in terms of reference to a great group, and they may represent the central concept of the great group or reflect properties that intergrade toward other classes. Families are made up of soil series grouped largely on the basis of properties important to the growth of plants. The soil series of Pierce County are listed in table 7 by family, subgroup, and order of the current system.

Detailed Descriptions of Soil Series

The soil series of Pierce County are described in the following pages. For each series, a representative profile of a soil type is described in detail. Unless otherwise stated, the colors given are those of a moist soil.

Adrian Series

The Adrian series consists of organic soils that are very poorly drained. These soils are in slight depressions on low stream terraces and on alluvial bottoms along streams. They are composed of 24 to 40 inches of the decomposed remains of grasses, sedges, reeds, and other nonwoody plants over sand and gravel. The remains of the plants are decomposed to the extent that the individual parts can no longer be identified. The water table is generally between a depth of 12 and 40 inches.

The Adrian soils occur with the Lawler and Orion soils. In contrast to those mineral soils, they consist primarily of organic matter from decomposed plant remains.

Representative profile of Adrian muck in a permanent pasture on the north side of South Fork Kinnickinnic River (SE¼SW¼ sec. 5, T. 27 N., R. 18 W., Pierce County, Wis.):

O1—0 to 4 inches, black (N 2/0) muck; moderate, medium, prismatic and moderate, coarse, crumb structure; friable; neutral reaction; clear, smooth boundary.

O2—4 to 16 inches, black (N 2/1) peaty muck; moderate, medium, platy structure; nonsticky; contains layers, up to 2 inches thick, of very dark brown (10YR 2/2), fine, fibrous, matted peat; slightly acid; clear, smooth boundary.

O3—16 to 29 inches, black (N 2/0) peaty muck; massive; nonsticky; slightly acid; abrupt, smooth boundary.

IIC—29 to 50 inches, light brownish-gray (10YR 6/2) sand; single grain; loose; contains fragments of limestone and sandstone and a thin layer of gravelly loam; mildly alkaline.

Adrian muck varies mainly in the total thickness of the layer of organic material over sand and gravel and in the thickness and composition of the individual layers of organic material. It also varies in the number of distinct layers. The total thickness of the layer of organic material ranges from 24 to 40 inches. The composition of the organic material varies in accordance with the amount of mineral material incorporated in the profile and in the degree of decomposition and disintegration of the organic material. In some places these soils contain layers, a few inches thick, of matted peat. The colors range from black (N 2/0) to very dark brown (10YR 2/2). In places as much as 6 inches of silty material has been deposited on the surface.

Almena Series

In the Almena series are somewhat poorly drained soils formed in a thick mantle of loess over glacial till of Iowan age. These soils are nearly level to sloping and are on the uplands. The original vegetation was a forest of deciduous trees, mainly maple and basswood.

These soils form a drainage sequence with the well drained Otterholt and moderately well drained Spencer soils. They also occur with well drained Renova, moderately well drained Vlasaty, and somewhat poorly drained Sargeant soils, which all formed in a thinner layer of silt over glacial till. In a few places, the Almena soils occur with very poorly drained Sable soils, and they formed in the same kind of material.

Representative profile of Almena silt loam in a cultivated field about one-quarter of a mile south of the village of Waverly (SE¼NE¼ sec. 20, T. 27 N., R. 16 W., Pierce County, Wis.):

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, very fine, subangular blocky structure; friable; moderately alkaline; clear, smooth boundary.

A2—8 to 12 inches, grayish-brown (10YR 5/2) silt loam; few, fine, distinct, dark yellowish-brown (10YR 4/4) mottles; moderate, very thin, platy structure; few patchy silt coats on the lateral faces of the structural peds; friable; very strongly acid; abrupt, smooth boundary.

B1—12 to 14 inches, grayish-brown (10YR 5/2) silt loam; few, fine, distinct, dark yellowish-brown (10YR 4/4) mottles; weak, thin to medium, platy and moderate, very fine, subangular blocky structure; thin silt coats on the vertical and horizontal faces of the structural peds; firm to friable; very strongly acid; abrupt, smooth boundary.

B21t—14 to 20 inches, dark-brown (10YR 5/3) light silty clay loam; few, fine, prominent, dark-brown and brown (7.5YR 5/2 or 4/4) mottles; weak, thick, platy and moderate, medium, subangular blocky structure; thick silt coats on the vertical and horizontal faces of the structural peds; firm; very strongly acid; clear, smooth boundary.

B22t—20 to 25 inches, brown (10YR 5/3) light silty clay loam; few to common, fine, prominent, dark-brown (7.5YR 4/4) and grayish-brown (10YR 5/2) mottles; weak, thick, platy and moderate, medium, subangular blocky structure; very thick silt coats and pockets on the vertical and horizontal faces of the structural peds, with the greatest thickness along the vertical cleavage planes; very strongly acid; clear, smooth boundary.

B3—25 to 45 inches, dark yellowish-brown (10YR 4/4) silt loam to heavy silt loam; few, fine, prominent, dark-brown (7.5YR 4/4) and grayish-brown (10YR 5/2) mottles; moderate, coarse, subangular blocky structure; strongly expressed vertical cleavage planes and general platiness; thick silt coats on the vertical faces of the structural peds; firm; very strongly acid; gradual, smooth boundary.

IIC—45 inches +, brown (10YR 5/3) sandy loam glacial till; few, fine, prominent, strong-brown (7.5YR 5/6) mottles; massive; very strongly acid.

In cultivated areas of Almena soils, the color of the surface layer ranges from very dark grayish brown (10YR 3/2) to grayish brown (10YR 5/2). In areas that have not been disturbed, the color of the A1 horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2). The thickness of the bleached silt coats on the surfaces of the peds and the degree of development of the clay films within the B horizons vary greatly. The thickness of the solum also varies greatly, or from 36 to 45 inches. The mantle of silty material ranges

TABLE 7.—*Classification of soils*

Series	Family	Subgroup	Order
Adrian	([1])	([1])	Histosol.
Almena	Fine silty, mixed, frigid	Aquic Glossoboralf	Alfisol.
Antigo	Fine silty over sandy skeletal, mixed, mesic	Typic Glossoboralf	Alfisol.
Arenzville	Coarse silty, mixed, nonacid, mesic	Typic Udifluvent	Entisol.
Arland	Fine loamy over sandy skeletal, mixed, mesic	Typic Hapludalf	Alfisol.
Auburndale	Fine loamy, mixed, frigid	Typic Ochraqualf	Alfisol.
Boone	Sandy, siliceous, acid, mesic	Typic Quartzipsamment	Entisol.
Burkhardt	Coarse loamy over sandy skeletal, mixed, mesic	Typic Argiudoll	Mollisol.
Chaseburg	Fine silty, mixed, nonacid, mesic	Cumulic Haplorthent	Entisol.
Chetek	Coarse loamy over sandy skeletal, mixed, thin, mesic	Typic Hapludalf	Alfisol.
Clyde	Fine loamy, mixed, mesic	Typic Haplaquoll	Mollisol.
Dakota	Fine loamy over sandy skeletal, mixed over siliceous, mesic.	Typic Argiudoll	Mollisol.
Derinda	Fine silty over fine, mixed over illitic, mesic	Typic Hapludalf	Alfisol.
Derinda, acid variant	Fine silty over fine, mixed over illitic, mesic	Typic Hapludalf	Alfisol.
Dickinson	Coarse loamy, siliceous, mesic	Typic Hapludoll	Mollisol.
Downs	Fine silty, mixed, mesic	Mollic Hapludalf	Alfisol.
Dubuque	Fine silty, mixed, mesic	Typic Hapludalf	Alfisol.
Dunbarton	Clayey montmorillonitic, thin, mesic	Lithic Hapludalf	Alfisol.
Edith	Sandy skeletal, siliceous, thin, mesic	Entic Hapludoll	Mollisol.
Fayette	Fine silty, mixed, mesic	Typic Hapludalf	Alfisol.
Floyd	Fine loamy, mixed, mesic	Aquic Argiudoll	Mollisol.
Freeon	Fine loamy, mixed, frigid	Typic Glossoboralf	Alfisol.
Freer	Fine loamy, mixed, frigid	Aquic Glossoboralf	Alfisol.
Gale	Fine silty over sandy, mixed, mesic	Typic Hapludalf	Alfisol.
Gale, thin solum variant	Fine silty over sandy, mixed, mesic	Typic Hapludalf	Alfisol.
Halder	Fine loamy over sandy skeletal, mixed, mesic	Aquollic Hapludalf	Alfisol.
Hesch	Fine loamy over sandy skeletal, mixed over siliceous, mesic.	Typic Argiudoll	Mollisol.
Hixton	Fine loamy over sandy skeletal, mixed over siliceous, mesic.	Typic Hapludalf	Alfisol.
Lamont	Coarse loamy, siliceous, mesic	Typic Hapludalf	Alfisol.
Lawler	Fine loamy over sandy skeletal, mixed, mesic	Aquic Hapludoll	Mollisol.
Meridian	Fine loamy over sandy skeletal, mixed over siliceous, mesic	Typic Hapludalf	Alfisol.
Onamia	Fine loamy, over sandy skeletal, mixed, mesic	Typic Hapludalf	Alfisol.
Orion	Coarse silty, mixed, nonacid, mesic	Aquic Udifluvent	Entisol.
Ostrander	Fine loamy, mixed, mesic	Typic Argiudoll	Mollisol.
Otterholt	Fine silty, mixed, frigid	Typic Glossoboralf	Alfisol.
Plainfield	Sandy, siliceous, acid, mesic	Typic Udipsamment	Entisol.
Port Byron	Fine silty, mixed, mesic	Typic Hapludoll	Mollisol.
Racine	Fine loamy, mixed, mesic	Mollic Hapludalf	Alfisol.
Renova	Fine loamy, mixed, mesic	Typic Hapludalf	Alfisol.
Renova, sandy variant	Fine loamy, mixed, mesic	Typic Hapladulf	Alfisol.
Rockton	Fine loamy, mixed, mesic	Typic Argiudoll	Mollisol.
Rozetta	Fine silty, mixed, mesic	Typic Hapludalf	Alfisol.
Sable	Fine silty, mixed noncalcareous mesic	Typic Haplaquoll	Mollisol.
Santiago	Fine loamy, mixed, frigid	Typic Glossoboralf	Alfisol.
Sargeant	Fine loamy, mixed, mesic	Aeric Ochraqualf	Alfisol.
Schapville	Fine, mixed, mesic	Typic Argiudoll	Mollisol.
Schapville, wet subsoil variant	Fine, mixed over illitic, mesic	Aquic Argiudoll	Mollisol.
Seaton	Fine silty, mixed, mesic	Typic Hapludalf	Alfisol.
Sogn	Loamy, mixed, thin, mesic	Lithic Hapludoll	Mollisol.
Sparta	Sandy, siliceous, mesic	Entic Hapludoll	Mollisol.
Spencer	Fine silty, mixed, frigid	Typic Glossoboralf	Alfisol.
Stronghurst	Fine silty, mixed, mesic	Aquic Hapludalf	Alfisol.
Tell	Fine silty over sandy skeletal, mixed over siliceous, mesic.	Typic Hapludalf	Alfisol.
Terril	Coarse loamy, mixed, nonacid, mesic	Cumulic Hapludoll	Mollisol.
Vlasaty	Fine loamy, mixed, mesic	Typic Hapludalf	Alfisol.
Waukegan	Fine silty over sandy skeletal, mixed over siliceous, mesic.	Typic Argiudoll	Mollisol.
Whalan	Fine loamy, mixed, mesic	Typic Hapludalf	Alfisol.
Worthen	Fine silty, mixed, nonacid, mesic	Cumulic Hapludoll	Mollisol.
Wykoff	Fine loamy, mixed, mesic	Typic Hapludalf	Alfisol.

[1] Not placed in a family or subgroup.

from 30 to 60 inches in thickness. The underlying till ranges from loam to clay loam in texture.

Antigo Series

The Antigo series consists of well-drained, moderately deep soils on stream terraces and outwash plains. These soils have formed in silty material over stratified gravelly and sandy outwash of glacial origin. The original vegetation was a deciduous forest of mixed hardwoods.

The Antigo soils occur with Onamia and Chetek soils. Like those soils, they have a substratum of gravelly outwash. Their solum is more silty, however, than those of the Onamia and Chetek soils, and it is thicker than that of the Chetek soils.

Representative profile of Antigo silt loam in a cultivated field (NE¼NW¼ sec. 7, T. 27 N., R. 19 W., Pierce County, Wis.):

Ap—0 to 7 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, fine, subangular blocky structure; friable; neutral reaction; clear, smooth boundary.

A2—7 to 11 inches, dark grayish-brown (10YR 4/2) silt loam; weak, thin, platy structure; vesicular; many worm holes; very dark grayish-brown (10YR 3/2) patchy coatings along the faces of some peds, adjacent to vertical cleavage planes; friable; neutral reaction; clear, smooth boundary.

B1—11 to 12 inches, dark-brown (10YR 3/3) silt loam; moderate, medium, subangular blocky (flaky) structure but displays some weak, medium plates; friable; neutral reaction; abrupt, smooth boundary.

B21t—12 to 17 inches, dark yellowish-brown (10YR 3/4) silt loam; fine, angular blocky structure; very pale brown (10YR 7/3), bleached silt coats and thin, continuous clay films on the faces of the peds; firm; slightly acid; clear, smooth boundary.

B22t—17 to 24 inches, dark yellowish-brown (10YR 3/4) heavy silt loam; strong, medium, angular blocky structure; very pale brown (10YR 7/3), bleached silt coats on the faces of most peds; dark-brown (10YR 3/3) coatings and thin clay films on the faces of the peds in the upper part of horizon; firm; slightly acid; clear, smooth boundary.

IIB31—24 to 26 inches, dark yellowish-brown (10YR 4/4) loam; weak, coarse, angular blocky structure; firm; slightly acid; abrupt, smooth boundary.

IIB32—26 to 28 inches, dark-brown (7.5YR 4/4) loam; weak, coarse, angular blocky structure; firm; slightly acid to medium acid; abrupt, smooth boundary.

IIC—28 to 48 inches, dark-brown (7.5YR 4/4) gravelly sand; loose; medium acid.

Antigo soils vary mainly in the thickness of the layer of silty material and in the characteristics of the substratum. The silty material is generally less than 30 inches thick, but the thickness ranges from 20 to 36 inches. The thickness of the surface layer ranges from 7 inches in moderately eroded soils to about 12 inches in soils that are not eroded. The combined thickness of the surface layer and subsoil ranges from 24 to 32 inches. The color of the surface layer in areas that have been cultivated ranges from very dark gray (10YR 3/1) to dark grayish brown (10YR 4/2). In areas that have not been disturbed, these soils have a thin A1 horizon that ranges from very dark grayish brown (10YR 3/2) to black (10YR 2/1) in color.

In places the texture in the lower B2 horizon is loam. The content of sand in the IIB31 horizon has been less influenced by loess than has that in the IIB32 horizon. The sand in the IIB32 horizon has a matrix of colloidal clay.

In some areas the substratum consists of gravelly sand, and it is stratified sand and gravel in other areas. In still other places, the substratum consists of coarse gravel, or it contains a layer of finer textured material. The substratum in some areas contains a layer of material weathered from limestone or shale. In those places the soil material in the substratum ranges from loam to gravelly loam in texture and is more coherent than normal for the gravelly and sandy material that makes up the substratum in most places.

Arenzville Series

The soils of the Arenzville series are well drained or moderately well drained and are nearly level or gently sloping. They have formed in deep, silty alluvium washed from loess-mantled uplands. These soils have a light-colored surface layer and are commonly underlain by a dark-colored, buried surface layer at a depth between 24 and 48 inches. They are on broad flood plains of the major streams and on narrow bottoms along the smaller streams. The original vegetation was hardwoods.

The Arenzville soils occur with areas of loamy Alluvial land and with Orion soils. Their profile resembles that of the Orion soils, but they have better drainage than those soils. The Arenzville soils are lighter colored than the Terril soils, but they occupy similar positions. They are more stratified than the Chaseburg soils, and unlike the Chaseburg soils, they are underlain by a buried surface layer.

Representative profile of Arenzville silt loam in a permanent pasture (SE¼SE¼ sec. 8, T. 25 N., R. 15 W., Pierce County, Wis.):

A1—0 to 9 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, very fine, subangular blocky structure; friable; mildly alkaline; abrupt, smooth boundary.

C—9 to 31 inches, dark grayish-brown (10YR 4/2) silt loam; weak, thin or very thin, platy structure; friable; mildly alkaline; abrupt, smooth boundary.

Alb—31 to 40 inches, black (10YR 2/1) silt loam; weak, fine, subangular blocky structure; very friable; mildly alkaline; abrupt, smooth boundary.

Cb—40 to 50 inches, dark grayish-brown (10YR 4/2) silt loam; weak, thin, platy structure; friable; neutral reaction.

In Arenzville soils minor variations in color occur throughout the profile. These are the results of layering, or they are caused by differences in the color of the sediment as a result of differences in the source of the soil material. In places a thin layer of sandy overwash covers the surface. Thin layers of sand occur throughout the profile in some places. In some areas the lower part of the profile is mottled. Mottling generally does not occur, however, within 18 inches of the surface.

Arland Series

The Arland series consists of moderately deep, well-drained soils that are medium textured. These soils have formed in a thin layer of medium-textured material over a thin deposit of glacial till. The glacial till, in turn, is underlain by bedrock or by material weathered from sandstone. Unweathered sandstone is at a depth of less than 40 inches. These soils commonly occur in a broad transitional belt, where the soils that formed in glacial material grade to sandy soils of unglaciated areas. The original vegetation was a forest of mixed hardwoods.

Arland soils occur with Wykoff and Hixton soils. Their profile is similar to that of the Wykoff soils. It differs mainly in that it has residual sand or sandstone in the lower part.

Representative profile of Arland loam in a cultivated field (NE¼SW¼ sec. 26, T. 26 N., R. 18 W., Pierce County, Wis.):

- Ap—0 to 8 inches, dark-brown (10YR 4/3) loam; weak, fine, subangular blocky structure; friable; medium acid; abrupt, smooth boundary.
- A21—8 to 10 inches, dark-brown (10YR 4/3) loam; moderate, thin, platy structure; friable; medium acid; abrupt, smooth boundary.
- A22—10 to 13 inches, brown (10YR 5/3) very fine sandy loam; moderate, thin, platy structure; friable; medium acid; clear, smooth boundary.
- B21t—13 to 20 inches, dark-brown (7.5YR 4/4) sandy clay loam; weak, thick, platy structure in place, breaking to moderate, medium, subangular blocky structure; firm; slightly acid; gradual, smooth boundary.
- B22t—20 to 24 inches, dark-brown (7.5YR 4/4) light sandy clay loam that contains lenses of sandy loam; moderate, medium, angular blocky structure; firm; medium acid; clear, smooth boundary.
- IIB3—24 to 29 inches, brown (10YR 5/3) sandy loam glacial till mixed with loamy sand weathered from sandstone; weak, medium to coarse, subangular blocky structure; firm; medium acid; gradual, smooth boundary.
- IIC—29 inches +, white (10YR 8/2) fine sand that contains yellowish-red (5YR 4/6 to 5/8) lenses or veins and grades to sandstone; single grain; medium acid.

The texture of the B horizons is dominantly sandy clay loam, but it ranges to loam or clay loam. The thickness of the layer of till over material weathered from sandstone ranges from 12 to 30 inches. When these soils are dry, the color of their surface layer is normally pale brown (10YR 6/3). The surface layer is generally less than 12 inches thick.

Auburndale Series

The Auburndale series consists of poorly drained soils in shallow depressions and in drainageways in the uplands. These soils developed in 30 to more than 36 inches of silt underlain by glacial drift. The original vegetation was a deciduous forest made up of different kinds of hardwoods.

The Auburndale soils occur in upland drainageways in the same general areas as the somewhat poorly drained Almena, moderately well drained Spencer, and well drained Otterholt soils.

Representative profile of Auburndale silt loam in a pasture about 100 feet south of a road in line with a farm driveway (NW¼NW¼ sec. 11, T. 27 N., R. 16 W., Pierce County, Wis.):

- A1—0 to 6 inches, very dark gray (10YR 3/1) silt loam; few, fine, prominent, dark-brown (7.5YR 4/4) mottles; weak, fine, granular structure; friable; slightly acid; clear, smooth boundary.
- A2—6 to 8 inches, dark-gray (10YR 4/1) silt loam; few, fine, prominent, dark-brown (7.5YR 4/4) mottles; black (10YR 2/1) and very dark gray (10YR 3/1) stains from organic matter; weak, thin, platy structure; friable; strongly acid; clear, smooth boundary.
- B1g—8 to 11 inches, gray (10YR 5/1) heavy silt loam; mottling same as that in A1 and A2 horizons; moderate, fine or very fine, subangular blocky structure; friable; strongly acid; clear, smooth boundary.
- B21tg—11 to 17 inches, dark-gray (5Y 4/1) heavy silt loam; common, fine, prominent, strong-brown (7.5YR 5/6) mottles; moderate, fine, angular blocky structure; firm; strongly acid; clear, smooth boundary.
- B22tg—17 to 26 inches, gray (5Y 5/1) heavy silt loam; common, fine, prominent, strong-brown (7.5YR 5/6) mottles; very dark gray (10YR 3/1) stains from organic matter; moderate, medium, subangular blocky structure; firm; very strongly acid; clear, smooth boundary.
- B23tg—26 to 43 inches, olive-gray (5Y 5/2) silt loam; common, medium, prominent, gray (5Y 5/1) mottles; very dark gray (10YR 3/1) stains from organic matter; weak, medium, subangular blocky structure; firm; slightly acid; clear, smooth boundary.
- IIC1—43 to 48 inches, yellowish-brown (10YR 5/4) sandy loam; common, medium, prominent, gray (10YR 5/1) mottles; massive; friable; neutral reaction; gradual, smooth boundary.
- IIC2g—48 inches +, olive-gray (5Y 5/2) loam; many, medium, prominent, yellowish-brown (10YR 5/4 to 5/6) mottles; massive; firm; neutral.

In many places a few inches of silty material has been deposited on the surface of these soils. In some places the surface is free of stones. In others stones are numerous enough to require clearing before these soils are used for crops. The A1 horizon ranges from 1 to 6 inches in thickness and from black (10YR 2/1) to very dark gray (10YR 3/1) in color. The B2 horizons range from silt loam to silty clay loam in texture. In places the profile lacks a layer of loam or sandy loam just above the loam till. In other places such a layer is present and ranges from only a few inches to about 24 inches in thickness. The texture of the underlying till ranges from sandy loam to clay loam. The degree of mottling varies throughout the profile.

Boone Series

The Boone series consists of soils that are excessively drained and that are gently sloping to very steep. These soils have formed under a cover of deciduous hardwoods, mostly oaks, in material weathered from sandstone. They are on undulating plains and on valley slopes. The original vegetation was a forest of mixed hardwoods.

Boone soils occur with the Hixton soils, but they have a coarser texture than those soils. To a lesser extent, they occur with Hesch soils, but they are lighter colored and coarser textured than those soils. Also, the Boone soils lack the illuvial B horizon that is typical in the Hixton and Hesch profiles.

Representative profile of Boone loamy fine sand in a cultivated field (SW¼NE¼ sec. 5, T. 27 N., R. 19 W., Pierce County, Wis.):

- Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) loamy fine sand; weak, fine, crumb structure; very friable; few fibrous roots; neutral reaction; abrupt, smooth boundary.
- C1—6 to 18 inches, yellowish-brown (10YR 5/6) loamy fine sand; very weak, medium, subangular blocky structure; very friable; medium acid; diffuse, smooth boundary.
- C2—18 to 42 inches, yellowish-brown (10YR 5/4) fine sand; structureless; loose; medium acid; gradual, smooth boundary.
- C3—42 to 60 inches, yellow (10YR 7/6 to 8/6) fine sand; structureless; loose; medium acid; clear, smooth boundary.
- R—60 inches +, pale-brown (10YR 6/3) and yellowish-brown (10YR 5/8), weakly cemented sandstone.

The greatest variation in the Boone profile is in the depth over consolidated sandstone. The depth ranges from a few inches to several feet. In most places where these soils are on talus slopes, they are deep and have fragments of sandstone on the surface and throughout the profile. In the areas in the northwestern part of the county, the sandy material in the substratum is mixed

with material weathered from limestone and shale. This finer textured material forms clearly defined bands or layers of coherent material. The bands are generally brown, and they range from sandy loam to sandy clay loam in texture.

Where these soils have not been disturbed, the A1 horizon ranges from 1 to about 3 inches in thickness and from very dark grayish brown (10YR 3/2) to black (10YR 2/1) in color. In general, the color of the surface layer in cultivated fields is dark grayish brown (10YR 4/2) or very dark grayish brown (10YR 3/2). In places, however, the yellowish substratum is exposed.

Burkhardt Series

The Burkhardt series consists of somewhat excessively drained, nearly level or gently sloping soils that are shallow over sandy and gravelly material. These soils have formed on stream terraces in stratified sand and gravel. They are most extensive along the Mississippi River, but they also occur along the St. Croix, Rush, and Trimbelle Rivers. The original vegetation was prairie grasses.

The Burkhardt soils occur with Dakota and Sparta soils and, to a lesser extent, with Plainfield soils. They are shallower over coarse-textured material than the Dakota and Sparta soils. Also, they have a gravelly instead of a sandy substratum like those of the Dakota and Sparta soils. The Burkhardt soils, unlike the Sparta and Plainfield, contain an illuvial B horizon, or horizon in which clay has accumulated. They are darker colored than the Plainfield soils.

Representative profile of Burkhardt sandy loam in a cultivated field (SW¼NW¼ sec. 1, T. 24 N., R. 18 W., Pierce County, Wis.):

Ap—0 to 7 inches, very dark brown (10YR 2/2) sandy loam; weak, fine, crumb structure; very friable; medium acid; clear, smooth boundary.

A12—7 to 10 inches, very dark brown (10YR 2/2) sandy loam; weak, fine and very fine, subangular blocky structure; very friable; medium acid; clear, smooth boundary.

B1—10 to 12 inches, dark reddish-brown (5YR 3/2) heavy sandy loam; weak, medium, subangular blocky structure; friable; dark-colored tongues of organic matter extend downward into this horizon from the A horizons; medium acid; abrupt, smooth boundary.

B2t—12 to 16 inches, dark reddish-brown (5YR 3/3) loam; weak, medium, subangular blocky structure; friable; thin, patchy clay films; medium acid; clear, smooth boundary.

IIB3—16 to 18 inches, dark reddish-brown (5YR 3/3) gravelly sandy loam; weak, medium, subangular blocky structure breaking to single grain under pressure; stains from organic matter on the faces of some peds; very friable; medium acid; clear, smooth boundary.

IIC—18 to 30 inches, dark-brown (7.5YR 4/4) stratified sandy gravel; single grain; loose; slightly acid.

The Burkhardt soils vary mainly in the color and texture of their surface layer and in the thickness of their solum. Their surface layer ranges from black (10YR 2/1) to very dark brown (10YR 2/2) in color and from loam to sandy loam in texture. Depth to gravelly outwash ranges from 12 to 24 inches. In the substratum the proportions of sand and gravel are variable.

Chaseburg Series

The soils of the Chaseburg series are mostly well drained but are moderately well drained in places. They have formed in deep, silty alluvial-colluvial deposits of material from the nearby loess-mantled uplands. Commonly, these soils are in upland draws in the same general areas as those in which other silty soils occur. They also occur on fans at the ends of draws and along the base of foot slopes occupied by steeper soils. Areas of these soils are small.

The Chaseburg soils are lighter colored than the Worthen, although they occupy similar positions on the landscape. They are less stratified than the Arenzville soils, and they lack the dark-colored buried surface layer that is typical in the profile of the Arenzville soils.

Representative profile of Chaseburg silt loam (SW¼SW¼ sec. 22, T. 25 N., R. 14 W., in adjacent Pepin County, Wis.):

A11—0 to 24 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine and medium, granular structure; very friable; abundant roots; neutral reaction; gradual, smooth boundary.

A12—24 to 32 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium, platy structure; friable; slightly acid; gradual, smooth boundary.

C2—42 inches +, yellowish-brown (10YR 5/4) silt loam; weak, medium, platy structure; friable; slightly acid; gradual, smooth boundary.

C2—42 inches, yellowish-brown (10YR 5/4) silt loam; weak, medium, platy structure; friable; medium acid.

Differences in the source of the sediments, and differences caused by layering and by irregularities in the deposited sediments, cause minor variations in color throughout the profile. In a few small areas, a thin layer of stones or of sandy or gravelly overwash has been deposited on the surface. Also, thin layers of sand occur throughout the profile in some places. Mottling occurs in some areas below a depth of about 18 inches.

Chetek Series

The Chetek series is made up of soils that are well drained. These soils formed in moderately coarse textured material that is shallow over sandy and gravelly glacial outwash that is stratified in most places. They are gently sloping to moderately steep and are on stream terraces and dissected outwash plains. The original vegetation was a forest of mixed hardwoods.

The Chetek soils occur with Onamia soils, and they developed in similar material. They also occur with Antigo soils but have a less silty solum than those soils. The Chetek soils are shallower over outwash gravel and sand than the soils with which they occur. They have a thinner, lighter colored surface layer than the Burkhardt soils.

Representative profile of Chetek sandy loam in a permanent pasture about 800 feet northwest of a farm driveway (SE¼NE¼ sec. 35, T. 27 N., R. 15 W., Pierce County, Wis.):

A1—0 to 6 inches, very dark grayish-brown (10YR 3/2) sandy loam; weak, fine, granular structure; very friable; medium acid; clear, smooth boundary.

A2—6 to 9 inches, dark grayish-brown (10YR 4/2) sandy loam; weak, medium, platy structure; very friable; slightly acid; abrupt, wavy boundary.

B1—9 to 15 inches, dark-brown (10YR 4/3) sandy loam; weak, medium, subangular blocky structure; friable; slightly acid; clear, smooth boundary.

B2—15 to 21 inches, dark-brown (10YR 4/3) sandy loam; weak, medium and coarse, subangular blocky structure; friable; thin, patchy clay films; contains stones and cobbles that begin at the upper boundary of this horizon; slightly acid; clear, smooth boundary.

IIC—21 to 42 inches +, dark-brown (7.5YR 4/4) fine gravel and sand; single grain; loose; slightly acid.

The thickness of the solum ranges from 12 to 24 inches. The surface layer ranges from dark brown (7.5YR 4/2) to very dark grayish brown (10YR 3/2) in color. Its thickness ranges from 7 inches in moderately eroded areas to 12 inches in areas that are not eroded. The B horizons range from 7 to 16 inches in combined thickness. The B2 horizon ranges from sandy loam to loam in texture. In the substratum the ratio of coarse sand to gravel is variable, but fine gravel is predominant. Where these soils are on stream terraces and are nearly level, they are nearly free of stones. Stones are common, however, in the steeper areas of complex slopes on the outwash plains.

Clyde Series

The Clyde series is composed of poorly drained soils that formed in 18 to 30 inches of windblown silt (loess) over glacial till. These soils are in nearly level areas or in slight depressions. They occur on glacial till plains in uplands in the northern half of the county. There, they formed under a cover of reeds, sedges, and other plants that tolerate a large amount of water.

The Clyde soils are a member of the drainage sequence that includes the well-drained Ostrander and the somewhat poorly drained or poorly drained Floyd soils. Physiographically, they occur with Auburndale and Sargeant soils.

Representative profile of Clyde silt loam in a wooded drainageway about 300 feet north of a town road (SE¼SE¼ sec. 3, T. 27 N., R. 16 W., Pierce County, Wis.):

A0—½ inch to 0, organic mat of partly decomposed leaves and fibrous roots.

A11—0 to 8 inches, black (10YR 2/1) silt loam; moderate, fine, crumb structure; friable; mildly alkaline; clear, smooth boundary.

A12—8 to 15 inches, black (10YR 2/1) silt loam; moderate, very fine, angular blocky structure; friable; neutral reaction; gradual, smooth boundary.

B21g—15 to 19 inches, olive-gray (5Y 5/2) silt loam; common, medium, prominent, strong-brown (7.5YR 5/8) mottles and dark-gray (5Y 4/1) stains caused by organic matter; moderate, fine, angular blocky structure; nonsticky; neutral reaction; clear, smooth boundary.

B22g—19 to 26 inches, gray (5Y 5/1) silt loam; many, coarse, prominent, reddish-brown (5YR 4/4) mottles around root channels; weak, fine, subangular blocky structure; nonsticky; neutral reaction; clear, smooth boundary.

IICg—26 to 29 inches, gray (5Y 5/1) loam; many, coarse, prominent, dark-brown (7.5YR 4/4) and reddish-brown (5YR 4/4) mottles; weak, fine, subangular blocky structure; nonsticky; contains a moderate proportion of fine and medium pebbles; neutral reaction; clear, smooth boundary.

IIC2g—29 to 42 inches, grayish-brown (2.5Y 5/2) sandy loam; massive; nonsticky; neutral reaction.

Some areas of Clyde soils have stones on the surface and throughout the profile. The black soil material in the A horizons ranges from 6 to 18 inches in thickness. Below the A horizons, the soil material is gleyed. In most places the surface layer has a texture of silt loam, but the texture is silty clay loam in some places. The layer of loamy sand to gravel, between the solum and the underlying till, ranges from only a thin smear to several inches in thickness. The texture of the substratum of glacial till ranges from gravelly loamy sand to clay loam.

Dakota Series

Well-drained, nearly level or gently sloping soils of stream terraces and outwash plains make up the Dakota series. These soils have formed in medium-textured material derived from sandstone, or in well-sorted glacial outwash. Generally, they are underlain by a substratum of loose, stratified sand. The original vegetation was tall prairie grasses.

The Dakota soils occur with Sparta, Burkhardt, and Waukegan soils. They have a higher proportion of medium-textured material in their solum than the Sparta soils. Also, they contain illuvial (Bt) horizons, or horizons where clay has accumulated, that are lacking in the Sparta profile. The Dakota soils have a thicker solum than the Burkhardt soils, and they lack the gravelly substratum typical of those soils. They lack the silty solum typical of the Waukegan soils.

Representative profile of an uneroded Dakota loam in a cultivated field (SE¼NE¼ sec. 14, T. 27 N., R. 19 W., Pierce County, Wis.):

Ap—0 to 8 inches, very dark gray (10YR 3/1) loam; weak, very fine, subangular blocky structure; friable; many fibrous roots; neutral reaction; clear, smooth boundary.

A3—8 to 11 inches, very dark grayish-brown (10YR 3/2) loam; weak, fine, subangular blocky structure; friable; slightly acid; clear, smooth boundary.

B1—11 to 14 inches, dark-brown (10YR 3/3) loam; weak, fine, subangular blocky structure; very dark grayish-brown (10YR 3/2) tongues of organic matter extend into this horizon from the A3 horizon; friable; slightly acid; clear, smooth boundary.

B21t—14 to 20 inches, dark-brown (10YR 3/3) loam; moderate, medium, subangular blocky structure; few patchy clay films; dark-colored stains from organic matter are on the faces of many peds; friable; slightly acid; clear, smooth boundary.

B22t—20 to 26 inches, dark yellowish-brown (10YR 3/4) heavy loam; moderate, medium, angular and subangular blocky structure; dark-colored stains from organic matter and thin, patchy clay films on the faces of the peds; firm; slightly acid; clear, smooth boundary.

B3—26 to 32 inches, dark-brown (7.5YR 4/4) sandy loam; weak, coarse, subangular blocky and prismatic structure; dark-colored stains from organic matter are on the faces of the peds along vertical cleavage planes; friable; medium acid; diffuse, smooth boundary.

C—32 to 51 inches +, yellowish-brown (10YR 5/6), stratified fine sand; structureless; loose; medium acid.

Dakota soils vary mainly in the texture of the surface layer, in the thickness of the solum, and in the characteristics of the substratum. The texture of the surface layer ranges from sandy loam to loam. In areas that are not eroded, the color of the surface layer is black (10YR 2/1), very dark brown (10YR 2/2), or very dark gray (10YR 3/1). The color of the surface layer in moderately eroded areas is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). The thickness of the solum ranges from 24 to 36 inches.

Depth to the substratum of sandy outwash ranges from 24 to 42 inches. The substratum of typical Dakota soils has a texture of fine sand to coarse sand, but it contains a small amount of fine gravel in places. The substratum of some Dakota soils on outwash plains in the northwestern part of the county contains a thin pebble line.

In a limited acreage of Dakota soils in broad valleys in the northwestern part of the county, the substratum is

loamy. In those areas a C1 horizon that has a texture of sand lies between the B3 horizon and the loamy material of the substratum. The texture of the loamy substratum ranges from sandy loam to sandy clay loam. In a small acreage, the Dakota soils are underlain by fissured dolomitic limestone at a depth between 36 and 42 inches.

Derinda Series

The Derinda series consists of well drained or moderately well drained soils that are nearly level to steep. These soils formed in windblown silt (loess) and in material weathered from shale over shale bedrock. They occupy the fringe areas of broad upland ridges. The original vegetation was a forest of mixed hardwoods.

Derinda soils occur with areas of well drained Renova, moderately well drained Vlasaty, and somewhat poorly drained Sargeant soils. They lie between those soils and areas of Steep stony and rocky land, which is on the side slopes of the ridges. They occur in less centrally located positions, at a slightly lower elevation, than the Renova, Vlasaty, and Sargeant soils. Also unlike those soils, which formed in silty material over glacial till, the Derinda soils formed in silty material over material weathered from shale. The Derinda soils occur with Schapville soils, and they have formed in the same kind of material as those soils. They formed under trees, however, instead of under grass, and they have a lighter colored surface layer than the Schapville soils.

Representative profile of Derinda silt loam in a cultivated field (NW¼NW¼ sec. 18, T. 27 N., R. 17 W., Pierce County, Wis.):

Ap—0 to 5 inches, very dark gray (10YR 3/1) silt loam; moderate, fine, granular to thin, platy structure.

A2—5 to 10 inches, brown (10YR 5/3) silt loam; moderate, thin, platy structure; friable; gray (10YR 6/1) silt coats on the faces of the peds; strongly acid; clear, wavy boundary.

B1—10 to 14 inches, brown (10YR 5/3) silt loam; weak, thick, platy structure breaking to fine, subangular blocky structure; friable; gray (10YR 6/1) silt coats on the structural faces of the peds; strongly acid; clear, gradual boundary.

B21t—14 to 20 inches, dark-brown (10YR 4/3) light silty clay loam; moderate, fine, angular blocky structure; firm; gray (10YR 6/1) silt coats on the faces of the peds; strongly acid; clear, wavy boundary.

IIB22t—20 to 25 inches, dark-brown (10YR 4/3) heavy silty clay loam; few, fine, distinct, yellowish-brown (10YR 5/8) mottles; moderate, medium, angular blocky structure; slightly hard when dry, plastic when wet; few shale chips and small, angular fragments of chert; clay films and a few gray (10YR 6/1) silt coats on the vertical faces of the peds; strongly acid; gradual, smooth boundary.

IIC—25 to 40 inches, light olive-brown (2.5Y 5/6) silty clay weathered from shale bedrock; few dark grayish-brown (10YR 4/2) stains from organic matter on the vertical faces of the peds; many, fine, distinct, grayish-brown (10YR 5/2) and yellowish-brown (10YR 5/8) mottles in the upper part of the layer; moderate to strong, medium, angular blocky structure in upper part of layer, grading to strong, thick, platy shale bedrock below a depth of 3 feet; hard when dry, plastic when wet; slightly acid in upper part of layer but weakly calcareous below a depth of 3 feet.

Characteristics of the Derinda soils vary mainly in the thickness of the layer of silty material, which ranges from 10 to 30 inches. The color of the surface layer ranges from very dark gray (10YR 3/1) to dark grayish brown (10YR 4/2). In some places a few inches of glacial till lies between the layer of silty material and the weathered shale. In general, the color of the shale substratum is between a grayish brown (2.5Y 5/2) and olive (5Y 5/3). In some places, however, the substratum contains a few to many spots or veins of clay that has a bluish color. In some areas mottling occurs in the B1 horizon, as well as in the lower B horizons and in the C horizon. The shale is generally calcareous, but it is slightly acid in some places.

Derinda Series, Acid Variants

The acid variants of the Derinda series are well drained or moderately well drained. They have formed in a mantle of silty material, 10 to 30 inches thick, over extremely acid shale (fig. 15). The lower part of the solum developed in material weathered from the shale. Areas of these soils on uplands are undulating or rolling, and those on valley slopes are gently sloping to steep. The original vegetation was a forest of mixed hardwoods.

The acid variants of the Derinda soils occur with Seaton soils, which also developed in a deep layer of silty material but are on ridgetops and on the lower valley

Figure 15.—**Profile of Derinda silt loam, acid variant.**

slopes. The acid variants of the Derinda series occupy slightly lower areas than the Gale soils and the thin solum variants of the Gale series. Unlike the acid variants of the Gale series, which are underlain by interlayered sandstone and siltstone, they have formed in silty material over shale.

Representative profile of Derinda silt loam, acid variant, in a cultivated field about 20 feet east of a county road (NW¼NW¼NW¼ sec. 32, T. 26 N., R. 15 W., Pierce County, Wis.):

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable; neutral to slightly acid; clear, smooth boundary.

A2—7 to 9 inches, grayish-brown (10YR 5/2) silt loam; moderate, thin, platy structure; friable; medium acid to strongly acid; clear, smooth boundary.

B1—9 to 11 inches, brown (10YR 5/3) silt loam; moderate, fine or very fine, subangular blocky structure but contains some medium plates; friable; very strongly acid; clear, smooth boundary.

B21t—11 to 14 inches, dark-brown (10YR 4/3) heavy silt loam; strong, fine, angular blocky structure; very firm; very thin silt coats and thin, patchy, high-contrast clay films on the vertical and horizontal faces of the structural peds; very strongly acid; clear, smooth boundary.

B22t—14 to 17 inches, dark-brown (10YR 4/3) light silty clay loam; very few, fine, prominent, yellowish-brown (10YR 5/8) mottles in the lower part of the horizon; strong, fine to moderate, angular blocky structure but contains weak to moderate, medium plates; very firm; many thick, patchy, high-contrast clay films (10YR 3/2) and light-colored, bleached silt coats on the vertical and on some horizontal faces of the structural peds; extremely acid; gradual, wavy boundary.

IIB3—17 to 20 inches, olive (5Y 5/3) heavy silty clay loam to silty clay; very few, fine, prominent, yellowish-red (5YR 4/8) mottles; moderate, medium, angular blocky structure (has stronger vertical than horizontal cleavage planes); contains moderate, medium plates; very firm; continuous, thick, high-contrast clay films on the vertical faces of the structural peds; extremely acid; diffuse, irregular boundary.

IIC—20 to 27 inches, olive-gray (5Y 5/2) silty clay; very few, fine, prominent, yellowish-brown (10YR 5/8) mottles; moderate, thin or very thin, platy structure; very firm; contains occasional weak, vertical cleavage planes; extremely acid; diffuse, smooth boundary.

IIR—27 to 32 inches, olive-gray (5Y 5/2) or light olive-gray (5Y 6/2) shale that has very thinly laminated, rather loosely bedded petrogenic structure; individual flakes or fragments of shale are extremely firm to indurated; many yellowish-brown (10YR 5/8) streaks of iron oxide on the horizontal planes; extremely acid; contains fossils of iron pyrite.

The acid variants of the Derinda series vary mainly in the thickness of the layer of silty material over weathered, clayey shale and in the degree of mottling in the lower part of the solum. The layer of silty material ranges from 10 to 30 inches in thickness. In areas where these soils are well drained, mottling is absent or begins in the lower part of the B22t horizon, where drainage is slightly restricted. The color of the shale ranges from pale brown (10YR 6/3) to olive gray (5Y 5/2) or light olive gray (5Y 6/2).

Dickinson Series

The Dickinson series consists of deep, gently sloping soils that are well drained. These soils are on high terraces and outwash plains near the St. Croix River. They have formed in windblown material that has a texture of very fine sand but is finer textured at a distance from the river than near the river. In Pierce County the Dickinson soils are slightly finer textured and have thicker A horizons than is generally considered modal for the series. The original vegetation was prairie grasses.

The Dickinson soils occur with Lamont soils, but they have a thicker, darker colored surface layer than those soils. Where they occur back from the river, they grade to Port Byron soils, which formed in deep, coarse, silty loess. The Dickinson soils occur less extensively with the Rockton than with the Lamont and Port Byron soils. Unlike the Rockton soils, which formed in medium-textured material over limestone bedrock, they formed in windblown very fine sand.

Representative profile of a Dickinson soil in a cultivated field about 100 feet west of State Highway No. 29 (SE¼NW¼SE¼ sec. 3, T. 26 N., R. 20 W., Pierce County, Wis.):

A11—0 to 15 inches, very dark grayish-brown (10YR 3/2) very fine sandy loam; weak, fine, granular structure; very friable; medium acid; diffuse, smooth boundary.

A12—15 to 19 inches, dark-brown (7.5YR 3/2) very fine sandy loam; weak, fine, granular structure; very friable; slightly acid; diffuse, smooth boundary.

B1—19 to 24 inches, dark-brown (7.5YR 3/4) very fine sandy loam containing brown or dark-brown (7.5YR 4/2) streaks and dark-brown (7.5YR 3/2) patches; weak, medium, subangular blocky structure; very friable; slightly acid; diffuse, smooth boundary.

B21—24 to 29 inches, dark-brown (7.5YR 4/2) very fine sandy loam containing dark-brown (7.5YR 3/2) patches; weak, medium, subangular blocky structure; very friable; slightly acid; abrupt, smooth boundary.

B22—29 to 34 inches, dark-brown (7.5YR 4/4) loam; weak, very thick, platy structure breaking to weak, coarse, subangular blocky structure; firm; few, thin, discontinuous, dark-brown (7.5YR 3/4) clay films; slightly acid; abrupt, smooth boundary.

C1—34 to 44 inches, dark-brown (7.5YR 4/4) very fine sandy loam; massive; very friable; slightly acid; clear, smooth boundary.

C2—44 to 60 inches, brown (7.5YR 5/4) very fine sandy loam; massive; very friable; medium acid.

The color of the surface layer ranges from very dark brown (10YR 2/2) to very dark grayish brown (10YR 3/2). The thickness of the solum is normally between 26 and 34 inches. Where dunelike mounds have formed, however, the solum is as much as 44 inches thick and the texture of the surface layer ranges to fine sandy loam. The substratum contains weakly defined layers that generally conform to the relief of the area. The profile generally contains a layer of material that is finer textured and more coherent than is typical in the rest of the profile.

Downs Series

The soils of the Downs series are well drained and are gently sloping or sloping. They have formed in the uplands in a deep layer of silty loess that is more than 42 inches thick. The original vegetation was a mixture of prairie grasses and scattered oaks, or it consisted of prairie grasses that were later replaced by a forest of hardwoods.

The Downs soils occur with Seaton and Dubuque soils. They have a darker colored surface layer and formed in finer textured loess than the Seaton soils. The Downs soils have a darker colored profile than the Dubuque soils. Also, they lack the substratum of weathered limestone typical of the material underlying the Dubuque soils. They differ from the Port Byron soils, primarily in having an A2 horizon.

Representative profile of a cultivated Downs silt loam (SE¼NW¼ sec. 13, T. 25 N., R. 18 W., Pierce County, Wis.):

- Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, fine, granular structure; friable; neutral; abrupt, smooth boundary.
- A2—9 to 11 inches, dark grayish-brown (10YR 4/2) silt loam; moderately thin to medium, platy structure; friable; neutral; clear, wavy boundary.
- B21t—11 to 18 inches, dark-brown (10YR 4/3) heavy silt loam; weak, thick, platy structure breaking to moderate, fine, subangular blocky; firm; slightly acid; clear, smooth boundary.
- B22t—18 to 22 inches, dark-brown (10YR 4/3) light silty clay loam; weak, thick, platy structure breaking to moderate, fine, subangular blocky; firm; dark-brown (10YR 3/3) clay films and a few bleached silt coats on the vertical and horizontal faces of the peds; medium acid; clear, smooth boundary.
- B23t—22 to 28 inches, dark-brown (10YR 4/3) light silty clay loam; weak, thick, platy structure breaking to moderate, fine, subangular blocky; firm; few dark-brown (10YR 3/3) clay films and few thick, bleached silt coats on the vertical and horizontal faces of the peds; strongly acid; clear, smooth boundary.
- B3—28 to 42 inches, dark-brown (10YR 4/3) heavy silt loam; few, fine, faint, dark yellowish-brown (10YR 4/4) mottles; weak, medium, subangular blocky structure; firm; few, fine, faint clay films and silt coats on the faces of the peds; strongly acid; gradual, smooth boundary.
- C—42 to 66 inches, dark-brown (10YR 4/3) silt loam; massive; friable; medium acid.

In some cultivated areas, the surface layer is dark grayish brown (10YR 4/2) instead of very dark grayish brown (10YR 3/2). It is black (10YR 2/1) or very dark gray (10YR 3/1) in some areas that have not been disturbed. Depth to limestone bedrock ranges from 42 inches to more than 10 feet. In some places glacial till is at a depth greater than 5 feet.

Dubuque Series

The Dubuque series consists of moderately deep, well-drained soils that are silty. These soils have formed on uplands in a mantle of loess over clayey material that weathered from dolomite. They are underlain by fissured dolomite. The original vegetation was a mixed forest of hardwoods.

The Dubuque soils occur with Seaton soils, but they have formed in a thinner layer of loess than the Seaton soils. They also occur with Otterholt and Renova soils, but unlike those soils, they lack glacial till within the profile.

Representative profile of Dubuque silt loam in a permanent pasture, about 150 feet west of the foundation of a building (NW¼NE¼NW¼ sec. 1, T. 24 N., R. 15 W., Pierce County, Wis.):

- Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable; medium acid; clear, smooth boundary.
- A2—7 to 9 inches, grayish-brown (10YR 5/2) silt loam; weak, medium, platy structure; friable; medium acid; clear, smooth boundary.
- B1—9 to 13 inches, brown (10YR 5/3) silt loam; weak, thick, platy structure breaking to weak, fine, subangular blocky; friable; few, thin, very pale brown (10YR 7/3), bleached silt coats on the faces of the peds; medium acid; clear, smooth boundary.
- B21t—13 to 22 inches, dark yellowish-brown (10YR 4/4) heavy silt loam; weak, thick, platy structure breaking to moderate, fine, subangular blocky; firm; few, thin, discontinuous, dark-brown (7.5YR 4/4) clay films on the vertical faces of the peds; strongly acid; clear, smooth boundary.
- B22t—22 to 28 inches, dark yellowish-brown (10YR 4/4) silty clay loam; weak, thick, platy structure breaking to strong, medium, angular blocky; firm; thin, continuous, dark yellowish-brown (10YR 3/4) clay films on the faces of the peds; strongly acid; clear, smooth boundary.
- IIB23t—28 to 35 inches, reddish-brown (5YR 4/4) clay loam; moderate, medium, angular blocky structure; firm; medium acid; clear, smooth boundary.
- IIC—35 to 43 inches, dark reddish-brown (5YR 3/4) clay; massive; sticky; mildly alkaline; abrupt, smooth boundary.
- IIR—43 inches +, fissured dolomite bedrock.

The thickness of the silty material over the clay weathered from dolomite ranges from 15 to 30 inches; from one-third to two-thirds of the lower part of the B horizon has formed in the clayey material. In some places in cultivated fields, the surface layer is very dark grayish brown (10YR 3/2), but it is dark grayish brown (10YR 4/2) in others. In areas that have not been disturbed, there is a thin A1 horizon that is darker colored in some places than the Ap horizon in cultivated areas. A few fragments of chert are on the surface and throughout the profile. The thickness of the clayey material underlying the silty material ranges from 1 inch to about 30 inches, but a thickness of 2 to 12 inches is most common.

Dunbarton Series

The soils of the Dunbarton series are well drained, silty, and shallow over dolomite. They have formed in a mantle of loess over material weathered from dolomite, and the B horizons developed mostly in material weathered from dolomite. These soils are gently sloping to steep. They are on rock-formed terraces and on uplands that are capped by dolomite and covered with loess. The original vegetation was a forest of mixed hardwoods.

The Dunbarton soils on the uplands occur with Dubuque soils, but they formed in a shallower layer of loess than those soils. They also occur with Renova soils, but unlike those soils, they lack glacial till within the profile. The profile of the Dunbarton soils resembles that of the Whalan soils. It differs in that it does not have a layer of glacial till over the dolomite.

Representative profile of Dunbarton silt loam in a permanent pasture (NW¼NE¼ sec. 16, T. 27 N., R. 15 W., Pierce County, Wis.):

- A1—0 to 2 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, very thin, platy and weak, very fine, subangular blocky structure; very friable; medium acid; abrupt, smooth boundary.
- A21—2 to 4 inches, dark grayish-brown (10YR 4/2) silt loam; weak, very thin, platy structure; very friable; medium acid; abrupt, smooth boundary.
- A22—4 to 6 inches, grayish-brown (10YR 5/2) silt loam; weak, very thin, platy structure; very friable; medium acid; abrupt, smooth boundary.
- B1—6 to 8 inches, brown (10YR 5/3) silt loam; weak, medium, subangular blocky structure but breaks, under slight pressure, to weak, medium, platy structure; friable; medium acid; abrupt, smooth boundary.
- B2t—8 to 12 inches, dark-brown (10YR 4/3) silt loam; moderate, medium to fine, angular blocky structure; firm; thin, patchy clay films; very thin, continuous coats of grayish brown (10YR 5/2) to light gray (10YR 7/2), bleached silt on all the faces of the peds; medium acid; clear, smooth boundary.

IIB22—12 to 17 inches, dark-brown (10YR 4/3 and 7.5YR 3/2) clay loam; strong, fine to medium, angular blocky structure; very firm; thin, continuous clay films along the primary structural cleavage planes; medium acid; clear, smooth boundary.

IIR—17 inches +, light-gray (10YR 7/2) to very pale brown (10YR 7/3), thinly bedded dolomite.

The thickness of the cap of silty material ranges from 10 to 15 inches. More than two-thirds of the B2t horizon has formed in clayey material weathered from dolomite. The thickness of the layer of clay loam ranges from about 1 inch to 30 inches, but it is commonly between 2 and 12 inches. Fragments of chert are common on the surface and throughout the profile in many places. The color of the surface layer in cultivated fields is very dark grayish brown (10YR 3/2) or dark grayish brown (10YR 4/2). In areas that are not disturbed, the A1 horizon is thin and is darker colored in some places than the surface layer in cultivated areas.

Edith Series

The Edith series consists of soils that are excessively drained and that are sloping to steep. These soils are on hilly glacial uplands in the northern half of the county. In some parts of the county, the Edith soils are mapped in complexes of soil types. In others they are mapped in complexes with Wykoff loams. The original vegetation was predominantly prairie grasses, but it included a few scattered trees.

The Edith soils have more gravel throughout their profile than the Wykoff soils, and their profile is not so well developed as that of the Wykoff soils. They also occur with Renova and Racine soils, but they have less silty material in the upper part of their profile than do those soils. Also, their profile is less well developed than those of the Renova and Racine soils.

Representative profile of Edith gravelly loam (SE¼NE¼ sec. 14, T. 27 N., R. 16 W., Pierce County, Wis.):

Ap—0 to 6 inches, very dark brown (10YR 2/2) gravelly loam; moderate, fine, granular structure; very friable; medium acid; abrupt, smooth boundary.

A1—6 to 12 inches, dark-brown (7.5YR 3/4) gravelly loam; moderate, fine, granular structure; very friable; neutral; clear, smooth boundary.

C—12 to 42 inches +, dark-brown (7.5YR 4/4) gravelly sandy loam; structureless; loose; slightly acid.

The color of the surface layer ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2). In some places the texture of the surface layer is loam, but it is sandy loam or gravelly loam in others. The surface layer is very gravelly in some severely eroded spots. Stones and cobbles are scattered on the surface and throughout the profile. The glacial drift in which these soils formed is stratified. In general, it ranges from gravelly loam to loamy sand in texture, but a few areas in which the texture is gravelly clay loam are included. About 70 percent of the underlying glacial drift is unsorted gravel, 20 percent consists of lenses of sand within the gravel, and 10 percent is stones and cobbles. Colloidal clay forms a coating on the surfaces of the pebbles and particles of sand. The reaction ranges from neutral to medium acid.

Fayette Series

The Fayette series consists of well-drained soils that formed in a deep layer of silt (42 inches or more thick). These soils are on stream terraces. The original vegetation was a deciduous forest consisting mainly of oaks, hard maples, and hickory trees.

The Fayette soils occur with the moderately well drained Rozetta and somewhat poorly drained Stronghurst soils, and they formed in similar material. Their profile resembles that of the Seaton soils, which developed in loess. Unlike the Seaton soils, however, they formed in silty alluvium of loessal origin. Also, their substratum shows slight stratification of colors and of coarse-textured and fine-textured silty material.

Representative profile of Fayette silt loam, benches, in a cultivated field about 600 feet east of County Highway U and 300 feet north of a field road (SW¼NE¼ sec. 27, T. 25 N., R. 15 W., Pierce County, Wis.):

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable; medium acid; abrupt, smooth boundary.

A2—8 to 10 inches, grayish-brown (10YR 5/2) or dark grayish-brown (10YR 4/2) silt loam; weak, thin, platy structure; friable; medium acid; clear, smooth boundary.

B1—10 to 14 inches, brown (10YR 5/3) silt loam; weak, medium, platy structure, breaking to weak, very fine, subangular blocky structure; friable; very strongly acid; clear, smooth boundary.

B21t—14 to 23 inches, dark yellowish-brown (10YR 4/4) heavy silt loam; weak, thick, platy structure in place, breaking to moderate, fine, subangular blocky structure; friable; thin, continuous silt coats on the horizontal faces of the peds; very strongly acid; clear, smooth boundary.

B22t—23 to 32 inches, dark-brown (10YR 4/3) light silty clay loam; weak, very thick, platy structure in place, breaking to strong, fine to medium, subangular blocky structure; firm; medium, discontinuous, dark-brown (7.5YR 4/4) clay films on the faces of the peds; thin, discontinuous silt coats on the horizontal faces of the peds; very strongly acid; clear, smooth boundary.

B3—32 to 42 inches, dark-brown (10YR 4/3) silt loam; moderate, coarse, subangular blocky structure; friable; few, thin, discontinuous, dark yellowish-brown (10YR 4/4) clay films on the faces of the peds; very strongly acid; clear, smooth boundary.

C1—42 to 57 inches, yellowish-brown (10YR 5/4) silt loam; massive; friable; upper boundary of this horizon consists of a band of yellowish-brown (10YR 5/4) sandy loam 1 inch thick; very strongly acid; abrupt, smooth boundary.

IIC2—57 to 60 inches +, yellowish-brown (10YR 5/4) sand; few small fragments of sandstone; single grain; loose; very strongly acid.

In places the color of the surface layer is very dark grayish brown (10YR 3/2) instead of dark grayish brown (10YR 4/2). The surface layer is darker colored before than after the soil is cultivated, and the color is somewhat lighter in eroded than in uneroded areas. In plowed fields the surface layer ranges from 6 to 10 inches in thickness. The thickness of the solum ranges from 36 to 42 inches. Depth of the silty material over sandy outwash ranges from 42 to 60 inches. In places layers of sand are below a depth of 42 inches.

Floyd Series

Soils that are somewhat poorly drained are in the Floyd series. The material in which they formed was a moderately thin mantle of loess over loam glacial till. These soils are in shallow depressions and in drainageways in the uplands. They are mainly in a general area in the northwestern part of the county, where most of the soils are dark colored. The original vegetation was prairie grasses.

The Floyd soils form a drainage sequence with the well-drained Ostrander and poorly drained Clyde soils. They occur with Ostrander and Racine soils and developed in similar material, but they are not well drained like those soils.

Representative profile of Floyd silt loam about 650 feet west of a town road (NW¼SW¼ sec. 30, T. 27 N., R. 19 W., Pierce County, Wis.):

A1—0 to 10 inches, very dark gray (10YR 3/1) silt loam; weak, thick, platy structure in place, breaking to moderate, fine, granular structure; friable; neutral reaction; clear, smooth boundary.

A12—10 to 18 inches, black (10YR 2/1) silt loam; moderate, fine, granular structure; very friable; neutral reaction; gradual, smooth boundary.

A3—18 to 21 inches, very dark gray (10YR 3/1) silt loam; common, fine, distinct, dark yellowish-brown (10YR 4/4) mottles; moderate, fine, granular structure; very friable; slightly acid; gradual, smooth boundary.

B1—21 to 24 inches, very dark gray (10YR 3/1) light silty clay loam; moderate, fine, angular blocky structure; firm; mottling same as that in A3 horizon; medium acid; clear, smooth boundary.

B21t—24 to 30 inches, dark grayish-brown (10YR 4/2) clay loam; many, fine, distinct, dark-brown (7.5YR 4/4) mottles; weak, medium, subangular blocky structure; firm; dark grayish-brown (2.5Y 4/2) coating on the vertical faces of the peds; medium acid; gradual, smooth boundary.

B22t—30 to 40 inches, dark grayish-brown (10YR 4/2) clay loam; many, fine, distinct, dark-brown (7.5YR 4/4) mottles; moderate, medium to coarse, subangular blocky structure; firm; dark grayish-brown (2.5Y 4/2) coating on the vertical faces of the peds; medium acid; gradual, smooth boundary.

C—40 inches +, dark-brown (7.5YR 4/4) clay loam; many, fine, prominent, grayish-brown (2.5Y 5/2) mottles; massive; medium acid.

The color of the surface layer ranges from very dark gray (10YR 3/1) to black (10YR 2/1). In general, the thickness of the layer of silty material over till ranges from 12 to 30 inches. In a few places, however, these soils have formed in a layer of silt deeper than 30 inches. The texture of the underlying till ranges from loam to clay loam. In a few areas, the Floyd soils have a stony surface layer.

Freeon Series

The Freeon series is composed of moderately well drained soils that have formed in 12 to 30 inches of windblown silty material (loess) over glacial till. These soils are gently sloping to sloping and are on ridgetops in the northern part of the county. The original vegetation was a deciduous forest of mixed hardwoods.

The Freeon soils occur with the well-drained Santiago and somewhat poorly drained Freer soils. They formed in the same kind of material as those soils, but they are not so well drained as the Santiago soils and are better drained than the Freer.

Representative profile of Freeon silt loam in a cultivated field (NE¼NE¼ sec. 3, T. 27 N., R. 16 W., Pierce County, Wis.):

Ap—0 to 7 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, very fine, subangular blocky structure; friable; slightly acid; abrupt, smooth boundary.

A2—7 to 11 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, thin, platy structure; very friable; medium acid; clear and gradual, irregular boundary.

B1&A2—11 to 14 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine, subangular blocky structure but breaks, under pressure, to weak, thin, platy structure; friable; few, fine, faint, dark-brown (10YR 4/3) and dark yellowish-brown (10YR 4/4) bands marginal to cleavage faces; tongues of soil material from the A2 horizon extend downward through this horizon; strongly acid; abrupt, smooth boundary.

B2t—14 to 18 inches, dark-brown (10YR 4/3) silt loam that has a slightly higher content of clay than the horizons above or below; many, medium, faint, dark yellowish-brown (10YR 4/4) to dark-brown (7.5YR 4/4) mottles; moderate, fine and medium, subangular blocky structure; friable; thin, patchy clay films; thin, lateral streaks of grayish-brown (10YR 5/2), bleached silt lie next to the underlying glacial till along the lower boundary of the horizon; very strongly acid; clear, smooth boundary.

B3g—18 to 25 inches, grayish-brown (10YR 5/2) gritty silt loam consisting of intermixed loess and till; moderate, medium, subangular blocky structure; friable; interiors of peds are dark brown (7.5YR 4/4), and exteriors are grayish brown (10YR 5/2); thin, continuous coats of bleached silt along the structural cleavage planes; strongly acid; gradual, smooth boundary.

IIC—25 to 36 inches, reddish-brown (5YR 4/4) loam to sandy loam glacial till; weak, medium, platy structure; firm; many spots of ferric hydroxide; medium acid.

In cultivated areas the color of the surface layer ranges from very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2). In areas that have not been disturbed, the color of the surface layer is generally darker. The thickness of the solum ranges from 20 to 32 inches. The glacial till that underlies these soils has a texture of loam or sandy loam and ranges from dark brown (7.5YR 4/4) to reddish brown (5YR 4/4) in color.

Freer Series

The Freer series is composed of somewhat poorly drained soils that are nearly level or gently sloping. These soils have formed in 12 to 30 inches of silty loess over glacial till. They are in slight depressions on ridgetops in the northern part of the county. The original vegetation was a forest of mixed hardwoods.

The Freer soils form a drainage sequence with the well drained Santiago and moderately well drained Freeon soils.

Representative profile of Freer silt loam in a cultivated field (SW¼NW¼ sec. 29, T. 27 N., R. 18 W., Pierce County, Wis.):

Ap—0 to 7 inches, black (10YR 2/1) silt loam containing intermixed streaks and patches of dark grayish-brown (10YR 4/2) soil material from the A2 horizon; weak, very fine, subangular blocky structure; firm; slightly acid; abrupt, smooth boundary.

A2—7 to 9 inches, grayish-brown (2.5YR 5/2) silt loam; many, medium, prominent, dark yellowish-brown (10YR 4/4) mottles; weak, very thin, platy structure; very friable; strongly acid; abrupt, smooth boundary.

B1g&A2—9 to 11 inches, grayish-brown (2.5YR 5/2) silt loam; many, fine, prominent, dark yellowish-brown (10YR 4/4) mottles; weak, fine, subanguar blocky structure but breaks, under pressure, to weak, thin, platy structure; friable; moderately thin, continuous, bleached silt coats along the lower extremities of some vertical cleavage planes; strongly acid; abrupt, smooth boundary.

B21tg—11 to 18 inches, grayish-brown (2.5YR 5/2) silt loam; moderate, coarse, prismatic structure that breaks, if disturbed, to moderate, medium, subangular blocks that, in turn, contain weak, medium to coarse plates; friable; thin, patchy clay films; moderately thin, continuous, bleached silt coats on the surfaces of included blocky peds; many, fine, prominent, grayish-brown (10YR 5/2) and dark-brown (7.5YR 4/4) mottles in the interiors of the peds; many spots of ferric hydroxide; strongly acid; clear, smooth boundary.

IIB22tg—18 to 23 inches, grayish-brown (10YR 5/2) loam glacial till; many, fine, prominent, grayish-brown (10YR 5/2) and dark-brown (7.5YR 4/4) to reddish-brown (7.5YR 4/4) mottles; weak, coarse, prismatic structure, but breaks, under pressure, to weak, medium, subangular blocky structure; firm; many spots of ferric hydroxide; strongly acid; clear, smooth boundary.

IIB3—23 to 26 inches, dark-brown (7.5YR 4/4) loam glacial till, but approximately 40 percent of the horizon consists of large patches of grayish-brown (10YR 5/2) till; weak, medium, subangular blocky structure; friable; washed fine sand forms a coating along the most prominent vertical cleavage planes; strongly acid; gradual, smooth boundary.

IIC—26 to 36 inches, reddish-brown (5YR 4/4) loam glacial till; weak, medium, platy structure; friable; medium acid.

In cultivated areas the color of the surface layer ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2). The thickness of the layer of silty material ranges from 12 to 30 inches. The solum ranges from 20 to 32 inches in thickness. The underlying glacial till ranges from loam to sandy loam in texture and from dark brown (7.5YR 4/4) to reddish brown (5YR 4/4 in color.

Gale Series

The Gale series consists of well-drained soils that formed in 20 to 40 inches of loess over sandstone. The lower part of the solum contains some sand that has weathered from the underlying sandstone. These soils are gently sloping to steep. They are on rolling uplands, mainly in the central and north-central parts of the county. The original vegetation was a forest of mixed hardwoods, mostly oaks, hickory trees, and maples.

The Gale soils occur with Seaton, Hixton, and Boone soils. Unlike the Seaton soils, they formed in less than 42 inches of loess. The Gale soils differ from the Hixton and Boone soils in having a solum that developed mainly in loess instead of in material weathered from sandstone.

Representative profile of Gale silt loam in a cultivated field (NE¼NE¼ sec. 22, T. 27 N., R. 17 W., about 250 feet southwest of the corner of the section, Pierce County, Wis.):

Ap—0 to 7 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, fine, granular structure; friable; neutral reaction; clear, smooth boundary.

A2—7 to 10 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, thin, platy structure; friable; neutral reaction; clear, smooth boundary.

B1—10 to 14 inches, dark-brown (10YR 4/3) silt loam; moderate, medium, platy structure, breaking to moderate, very fine, subangular blocky structure; friable; medium acid; clear, smooth boundary.

B2t—14 to 24 inches, dark yellowish-brown (10YR 4/4) silt loam; strong, medium, subangular blocky structure; firm; thin, discontinuous, dark-brown (7.5YR 4/4) clay films on the faces of the peds; very strongly acid; clear, smooth boundary.

IIB3—24 to 30 inches, yellowish-brown (10YR 5/4) loam; moderate, medium, subangular blocky structure; friable; thick, dark-brown (7.5YR 4/4) clay films on the vertical faces of the peds; yellowish-brown (10YR 5/6) very fine sand coats on the remaining faces of the peds; strongly acid; clear, smooth boundary.

IIC—30 to 42 inches, light yellowish-brown (10YR 6/4) sand; single grain; loose; strongly acid.

In some areas that have been cultivated, the color of the surface layer is dark grayish brown (10YR 4/2) instead of very dark grayish brown (10YR 3/2). In areas that have not been disturbed, the profile contains a thin A1 horizon that is darker colored than the Ap horizon shown. The solum ranges from 24 to 36 inches in thickness. Depth to sandstone bedrock ranges from 36 to 50 inches. The color of the sandstone ranges from yellow to white.

Gale Series, Thin Solum Variants

The thin solum variants of the Gale series are well drained and are moderately shallow over bedrock. They have formed in material weathered from indurated, thinly bedded and interlayered siltstone and sandstone. These are gently sloping to steep soils on the side slopes of valleys. They occupy an area 9 square miles in size in the upper reaches of the watershed of Plum Creek.

The thin solum variants of the Gale series occur with the acid variants of the Derinda series and with Gale soils. They differ from the acid variants of the Derinda series in that they have a thinner solum. Also, they developed in material weathered from interlayered siltstone and sandstone instead of in material weathered from acid shale. The thin solum variants of the Gale series have a thinner solum than the Gale soils. In addition, they developed in material weathered from thinly bedded siltstone and sandstone instead of in material weathered from massive sandstone. The original vegetation was a deciduous forest of mixed hardwoods.

Representative profile of Gale silt loam, thin solum variant, in a permanent pasture about 15 feet south of a town road (NE¼NW¼ sec. 30, T. 26 N., R. 15 W., Pierce County, Wis.):

A0—2 inches to 0, very dark gray (10YR 3/1) organic matter consisting of the partly decomposed and matted remains of plants; medium acid; clear, smooth boundary.

A1—0 to 3 inches, very dark grayish-brown (10YR 3/2) coarse silt loam to loam; weak, fine to very fine, granular structure; very friable; contains many worm casts; contains the remains of insects and a few fine pellets of sandstone; strongly acid; clear, smooth boundary.

A2—3 to 7 inches, grayish-brown (10YR 5/2) coarse silt loam; moderate, thin to very thin, platy structure; friable; contains numerous fine pellets and small fragments of sandstone; strongly acid; clear, smooth boundary.

B1—7 to 9 inches, dark-brown (10YR 4/3) silt loam; moderate, fine, subangular blocky structure but breaks to weak, medium, platy structure; friable; contains numerous fine pellets and small fragments of sandstone; strongly acid; clear, smooth boundary.

B2t—9 to 13 inches, yellowish-brown (10YR 5/4) silt loam showing a slight accumulation of clay; moderate, fine to very fine, subangular blocky structure displaying very weak platiness; firm; thin, patchy clay films; contains many fragments of sandstone; the fragments are more numerous toward the lower boundary of the horizon than in the upper part; strongly acid; clear, smooth boundary.

B3—13 to 16 inches, yellowish-brown (10YR 5/4) to dark-brown (10YR 4/3) silt loam; weak, fine, subangular blocky structure displaying very weak platiness; friable; contains many fragments of sandstone and a few low-contrast clay films on the vertical faces of the structural peds; strongly acid; gradual, smooth boundary.

C—16 to 20 inches, brown (10YR 5/3) to pale-brown (10YR 6/3) material weathered from siltstone and a smaller amount of material weathered from sandstone in lenses, pockets, and layers among fragments of indurated sandstone; the silty part of the matrix is structureless; medium acid; gradual, smooth boundary.

R—20 to 29 inches, very pale brown (10YR 7/4), interlayered, thinly bedded, indurated siltstone and sandstone; contains thin, low-contrast, brownish-yellow (10YR 6/8) lenses of iron oxide; medium acid.

The texture of the surface layer is dominantly silt loam, but it ranges to fine sandy loam in cultivated areas where material from the underlying sandstone is mixed with the surface soil. The color of the surface layer ranges from very dark gray (10YR 3/1) in areas that have not been cultivated to very dark grayish brown (10YR 3/2) in cultivated areas. The thickness of the solum ranges from 10 to 24 inches. In places the sandstone bedrock underlying these soils is so close to very strongly acid shale that the reaction of these soils is affected.

Halder Series

The Halder series consists of somewhat poorly drained soils that are nearly level. These soils are on low stream terraces. They have formed in 24 to 42 inches of loamy material over outwash gravel and sand of sandstone and glacial origin. The original vegetation was a deciduous forest of oak, maple, and basswood.

The Halder soils occur with well-drained Onamia and Antigo soils, and they form a drainage sequence with the Onamia soils. They are not well drained like the Antigo soils, and their solum is loamy instead of silty like that of the Antigo soils.

Representative profile of Halder loam in a cultivated field at the side of a road, about 100 feet north of the channel of a stream (SW¼SW¼ sec. 34, T. 27 N., R. 17 W., Pierce County, Wis.):

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) loam; weak, fine, granular structure; friable; moderately alkaline; clear, smooth boundary.

A12—6 to 8 inches, dark grayish-brown (10YR 4/2) loam; weak, fine, subangular blocky structure; friable; moderately alkaline; abrupt, smooth boundary.

A2—8 to 11 inches, grayish-brown (10YR 5/2) loam; common, medium, faint, dark yellowish-brown (10YR 4/4) mottles; weak, medium, platy structure; friable; stones common; slightly acid; clear, smooth boundary.

B1—11 to 15 inches, dark-brown (10YR 4/3) loam; common, medium, distinct, dark-brown (7.5YR 4/4) and grayish-brown (10YR 5/2) mottles; weak, medium, subangular blocky structure; friable; stones common; medium acid; clear, smooth boundary.

B21t—15 to 20 inches, dark-brown (10YR 4/3) heavy loam; many, coarse, distinct, dark-brown (7.5YR 3/2 to 7.5YR 4/4) and grayish-brown (10YR 5/2) mottles; few dark-brown (7.5YR 3/2) stains; moderate, medium, subangular blocky structure; friable; thin, patchy clay films; a small amount of medium-sized pebbles; strongly acid; clear, smooth boundary.

B22t—20 to 23 inches, dark-brown (10YR 4/3) light sandy clay loam; mottling same as that in the B21t horizon and a few stains of manganese; moderate, medium and coarse, subangular blocky structure; firm; gravel like that in the B21t horizon; strongly acid; clear, smooth boundary.

B3—23 to 32 inches, dark-brown (7.5YR 4/4) and grayish-brown (10YR 5/2) sandy loam; weak, coarse, subangular blocky structure; friable; a small amount of fine gravel; strongly acid; clear, smooth boundary.

C—32 to 42 inches +, dark-brown (7.5YR 4/4), medium and fine stratified gravel; single grain; loose; strongly acid.

The Halder soils vary mainly in the thickness of the solum and in the relative proportions of medium and fine gravel and sand in the substratum.The solum ranges from 24 to 42 inches in thickness. In places the color of the surface layer is very dark grayish brown (10YR 3/2) instead of dark grayish brown (10YR 4/2). The texture of the surface layer is almost a silt loam in some places. In areas that have not been limed, the reaction of the surface layer is slightly acid to strongly acid. The reaction of the surface layer is neutral to moderately alkaline in areas where lime has been added. In places a water table is below a depth of 30 inches.

Hesch Series

The Hesch series consists of deep, well-drained soils that formed in medium-textured material over material weathered from sandstone. These soils are gently sloping to moderately steep. They are in the northwestern and north-central parts of the county. In some places they occur on talus slopes. The original vegetation was prairie grasses.

The Hesch soils have a thinner, lighter colored surface layer than the Hixton soils, although the soils of the two series formed in similar material. They occur with Dakota and Sparta soils, but they developed in medium-textured material over material weathered from sandstone, instead of in sandy outwash.

Representative profile of Hesch fine sandy loam, loamy substratum, in a cultivated field (SW¼SE¼ sec. 10, T. 26 N., R. 18 W., Pierce County, Wis.):

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) fine sandy loam; weak, very fine, subangular blocky structure; neutral reaction; clear, smooth boundary.

A1—8 to 10 inches, very dark grayish-brown (10YR 3/2) fine sandy loam; weak, fine, subangular blocky structure; friable; neutral reaction; abrupt, smooth boundary.

B1—10 to 14 inches, dark-brown (10YR 3/3) fine sandy loam; weak, fine, subangular blocky structure; friable; neutral reaction; clear, smooth boundary.

B2t—14 to 18 inches, dark-brown (10YR 4/3) loam; weak and medium, fine, subangular blocky structure; films of organic matter on the faces of a few peds; friable; thin, patchy clay films; slightly acid; clear, smooth boundary.

B3—18 to 23 inches, dark-brown (10YR 4/3) fine sandy loam; weak, medium and coarse, subangular blocky structure; friable; slightly acid; clear, smooth boundary.

C—23 to 28 inches, dark yellowish-brown (10YR 4/4) loamy fine sand; generally structureless; loose; slightly acid; clear, smooth boundary.

B2b—28 to 34 inches, dark-brown (7.5YR 4/4) heavy loam; moderate, medium, subangular blocky structure; few clay films on the faces of the peds, and sand coats on some primary vertical cleavage planes; firm; slightly acid; clear, smooth boundary.

Cb—34 to 50 inches, dark yellowish-brown (10YR 4/4) and strong-brown (7.5YR 5/6) sandy clay loam; generally massive; firm; slightly acid.

The surface layer ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2) in color and from loam to fine sandy loam in texture. The solum ranges from 22 to 40 inches in thickness. In some areas sandstone bedrock is within 42 inches of the surface, but it is at a greater depth in most places. In the northwestern part of the county, where most areas of Hesch soils occur, the solum is generally thicker than in other places and depth to bedrock is normally greater than 42 inches. In that area the substratum consists of a mixture of material weathered from sandstone and of material weathered from limestone. The material weathered from limestone forms bands and layers that range from sandy loam to sandy clay loam in texture. Where the Hesch soils occur on talus slopes, fragments of sandstone and limestone are common on the surface and throughout the profile.

Hixton Series

The Hixton series consists of well-drained soils that formed in material weathered from fine-grained sandstone. These soils are gently sloping to steep. They are on sandstone uplands and valley slopes. In some places they occur on talus slopes. Fragments of sandstone and limestone are common on the surface and throughout the profile. The original vegetation was a forest of mixed hardwoods.

The Hixton soils occur with Boone, Gale, and Arland soils. Unlike the Boone soils, they have a textural B horizon. They differ from the Gale soils in having developed in material from sandstone instead of in a moderately deep layer of loess over sandstone. Their profile is similar to that of the Arland soils, but they developed in material weathered from sandstone instead of in a thin layer of glacial till over sandstone.

Representative profile of Hixton loam (SE¼SW¼ sec. 31, T. 27 N., R. 18 W., Pierce County, Wis.):

Ap—0 to 7 inches, very dark grayish-brown (10YR 3/2) loam; weak, fine, subangular blocky structure; friable; neutral reaction; abrupt, smooth boundary.

A2—7 to 8 inches, grayish-brown (10YR 5/2) loam; weak, thin, platy structure; very friable; slightly acid; abrupt, smooth boundary.

B1—8 to 11 inches, dark-brown (10YR 4/3) loam; weak, thin, platy and weak, fine, subangular blocky structure; friable; strongly acid; clear boundary.

B21t—11 to 16 inches, dark-brown (10YR 4/3) heavy loam; moderate, fine, subangular blocky structure; firm; few patchy clay films; strongly acid; clear boundary.

B22t—16 to 24 inches, dark yellowish-brown (10YR 4/4) heavy loam; moderate, medium, subangular blocky structure; firm; clay films common; strongly acid; clear, smooth boundary.

B3—24 to 36 inches, dark yellowish-brown (10YR 4/4) loam; weak, medium, subangular blocky structure; friable; strongly acid; gradual, smooth boundary.

C1—36 to 42 inches, brownish-yellow (10YR 6/6) fine sand; structureless; loose; medium acid; gradual, smooth boundary.

C2—42 to 65 inches +, very pale brown fine sand; structureless; loose; medium acid.

The surface layer ranges from fine sandy loam to loam in texture. When moist, the surface layer is very dark grayish brown (10YR 3/2) or dark grayish brown (10YR 4/2). When dry, it is light brownish gray (10YR 6/2) to light gray (10YR 7/2). The solum ranges from 20 to 40 inches in thickness. Where these soils occur in the central and north-central parts of the county, the substratum generally consists of sandstone bedrock and of material weathered from bedrock. In those places the substratum is generally within 42 inches of the surface. Where these soils occur on valley slopes in the northwestern part of the county, the substratum generally consists of a mixture of material weathered from sandstone and limestone. The substratum in the northwestern part of the county contains thin layers of sandy loam to sandy clay loam. In the areas of Hixton soils on talus slopes, the solum is thicker than in other places and bedrock is generally at a depth between 42 and 60 inches.

Lamont Series

The soils of the Lamont series are well drained and are gently sloping to moderately steep. They have formed in a thick mantle of windblown deposits of very fine sand, on high stream terraces along the St. Croix and Mississippi Rivers. The original vegetation was a deciduous forest consisting mainly of oaks.

The Lamont soils developed in coarser textured windblown material than the Seaton and Port Byron soils. They are coarser textured than the Seaton soils and are slightly lighter colored than the Port Byron. They occur with the Meridian and Chetek soils but have a finer textured substratum than those soils.

Representative profile of Lamont very fine sandy loam in a permanent pasture (NE¼NW¼ sec. 3, T. 26 N., R. 20 W., Pierce County, Wis.):

Ap—0 to 6 inches, very dark grayish-brown (10YR 3/2) very fine sandy loam; weak, very fine, granular structure; friable; strongly acid; clear, smooth boundary.

A2—6 to 12 inches, dark grayish-brown (10YR 4/2) very fine sandy loam; weak, medium, platy structure; friable; strongly acid; abrupt, smooth boundary.

B1—12 to 17 inches, dark-brown (10YR 4/3) very fine sandy loam; weak, medium, subangular blocky structure; friable; medium acid; clear, smooth boundary.

B21—17 to 22 inches, dark-brown (10YR 4/3) very fine sandy loam; moderate, medium, subangular blocky structure; friable; thin, patchy clay films; medium acid; clear, smooth boundary.

B22—22 to 26 inches, dark-brown (7.5YR 3/4) very fine sandy loam; contains a larger proportion of fine-textured material than does the B21 horizon; moderate, medium, subangular blocky structure; friable; medium acid; clear, smooth boundary.

B3—26 to 31 inches, dark-brown (7.5YR 3/4) very fine sandy loam; weak, coarse, subangular blocky structure; very friable; medium acid; clear, smooth boundary.

C1—31 to 36 inches, dark-brown (7.5YR 3/4) loamy very fine sand; massive; very friable; medium acid; abrupt, smooth boundary.

C2—36 to 41 inches, dark reddish-brown (5YR 3/2) loam; massive; firm; medium acid; abrupt, smooth boundary.

C3—41 to 48 inches +, brown (7.5YR 5/4) loamy very fine sand; massive; very friable; medium acid.

The surface layer in cultivated areas is very dark grayish brown (10YR 3/2) or dark grayish brown (10YR 4/2). In undisturbed areas the color of the A1 horizon ranges from very dark grayish brown (10YR 3/2) to black (10YR 2/1). The texture of the surface layer is mainly very fine sandy loam, but it is mostly fine sandy loam in areas where the wind has formed mounds that resemble dunes. In general, the solum is between 26 and 36 inches thick, but it is as much as 42 inches thick in places where mounding has occurred. The substratum consists mainly of layers of very fine sandy loam and of loamy very fine sand. In places, however, the coarser textured material contains thin layers of loam or silt loam. This layering generally conforms to the topography of the area.

Lawler Series

The Lawler series consists of moderately deep, somewhat poorly drained soils that are mainly nearly level. These soils are on low stream terraces in the broad valleys in the north-central part of the county. They have formed in medium-textured material derived from sandstone, or from well-sorted glacial outwash underlain by sandy outwash. The original vegetation was prairie grasses.

The Lawler soils occur with Dakota soils and with areas of Alluvial land. They developed in about the same kind of material as the Dakota soils but are somewhat poorly drained instead of well drained.

Representative profile of Lawler loam in a cultivated field about 300 feet southeast of the corner of a woodlot (NE¼SW¼NW¼ sec. 26, T. 27 N., R. 18 W., Pierce County, Wis.):

Ap—0 to 8 inches, black (10YR 2/1) loam; moderate, very fine, granular structure; friable; neutral reaction; abrupt, smooth boundary.

A1—8 to 12 inches, very dark gray (10YR 3/1) loam; weak, fine, granular structure; friable; slightly acid; clear, smooth boundary.

A3—12 to 16 inches, very dark grayish-brown (10YR 3/2) loam; many pink (7.5YR 7/4), very pale brown (10YR 7/4), and grayish-brown (10YR 5/2) mottles; weak, thick, platy structure breaking to weak, fine, subangular blocky structure; friable; medium acid; clear, smooth boundary.

B2—16 to 28 inches, brown (10YR 5/3) loam; many, gray (10YR 5/1), dark-brown (7.5YR 4/4), and yellowish-red (5YR 5/8) mottles; moderate, medium to thick, platy structure breaking to very fine, moderate, subangular blocky structure; firm; has stains of organic matter on the faces of the peds and in root channels; strongly acid; clear, smooth boundary.

B3—28 to 36 inches, grayish-brown (10YR 5/2) loam; many, dark-brown (7.5YR 4/4), strong-brown (7.5YR 5/6), and light brownish-gray (10YR 6/2) mottles; weak, medium, subangular blocky structure; friable; slightly acid; clear, smooth boundary.

IIC—36 to 50 inches, bands of yellowish-brown (10YR 5/4) and pale-brown (10YR 6/3) sand; single grain; loose; has a high content of limestone fragments and small quartz stones; mildly alkaline.

The color of the surface layer ranges from black (N 2/0) to very dark brown (10YR 2/2). The texture of the surface layer ranges from loam to silt loam. The substratum consists mainly of loose sand, but it contains a small amount of gravel and fragments of limestone. In some places it contains layers of loamy material. Depth to the substratum of loose sand ranges from 24 to 40 inches. In places the underlying material has a texture of sandy loam or clay loam.

Meridian Series

The Meridian series consists of well-drained soils of stream terraces. These soils have formed in 20 to 40 inches of medium-textured material over stratified outwash sand. They are nearly level to sloping. The original vegetation was a forest of mixed hardwoods.

In the southern and eastern parts of the county, the Meridian soils occur with Tell soils, but they have less silty material in the solum than those soils. In the north-central and northwestern parts of the county, they occur with Onamia soils. Unlike those soils, which are also loamy but are underlain by coarse sand and gravel, they are generally underlain by medium sand. The Meridian and Dakota soils formed in similar material, but the Meridian soils have a thinner, lighter colored surface layer than the Dakota soils.

Representative profile of Meridian loam in a pasture (SE¼NE¼ sec. 2, T. 24 N., R. 15 W., Pierce County, Wis.):

A1—0 to 5 inches, very dark grayish-brown (10YR 3/2) loam; weak, very fine, subangular blocky structure; friable; slightly acid; clear, smooth boundary.

A21—5 to 8 inches, dark grayish-brown (10YR 4/2) loam; weak, very thin, platy structure; very friable; slightly acid; abrupt, smooth boundary.

A22—8 to 10 inches, dark grayish-brown (10YR 4/2) and dark-brown (10YR 4/3) loam; weak, thin, platy structure; very friable; medium acid; abrupt, smooth boundary.

B1—10 to 12 inches, dark-brown (10YR 4/3) and dark grayish-brown (10YR 4/2) loam; weak, fine, subangular blocky structure but breaks, under pressure, to weak, thin, platy structure; friable; medium acid; abrupt, smooth boundary.

B21t—12 to 15 inches, dark-brown (10YR 4/3) loam; moderate, fine and medium, angular blocky structure but breaks to weak, medium, platy structure; firm; strongly acid; clear, smooth boundary.

B22t—15 to 19 inches, dark-brown (10YR 4/3) heavy loam; moderate, fine and medium, angular blocky structure but breaks to weak, medium, platy structure; firm; has a few thin, patchy clay films on the faces of the peds; strongly acid; clear, smooth boundary.

B23t—19 to 24 inches, dark yellowish-brown (10YR 4/4) heavy loam; moderate, medium, angular blocky structure; firm; thin, patchy clay films common on the faces of the peds; strongly acid; clear, smooth boundary.

B3—24 to 28 inches, dark-brown (10YR 4/3) and dark yellowish-brown (10YR 4/4) loam to sandy loam; moderate, coarse, angular blocky structure; friable; thin, dark-brown (7.5YR 3/2) clay films continuous along primary vertical cleavage planes; strongly acid; clear, smooth boundary.

C—28 to 40 inches, yellowish-brown (10YR 5/4), stratified sand; single grain; loose; medium acid.

In places the color of the surface layer is dark grayish brown (10YR 4/2) instead of very dark grayish brown (10YR 3/2). The thickness of the solum ranges from 24 to 42 inches. The texture of the subsoil ranges from loam to sandy clay loam. In places the substratum is made up of layers of soil material that range from sandy loam to sandy clay loam in texture.

Onamia Series

The Onamia series consists of moderately deep soils that are well drained. These are nearly level to moderately steep soils. They have formed in medium-textured or moderately coarse textured material over sandy and gravelly glacial outwash. The original vegetation was mixed hardwoods.

The Onamia soils occur with Chetek soils and have formed in similar material. They have a finer textured solum, however, than the Chetek soils. They also occur with Antigo soils, but unlike those soils, which are silty, they have a solum that is mainly loamy.

Representative profile of Onamia loam in a permanent pasture (SW¼NW¼ sec. 6, T. 27 N., R. 19 W., Pierce County, Wis.):

Ap—0 to 7 inches, very dark grayish-brown (10YR 3/2) loam; weak, fine, subangular blocky structure; friable; medium acid; clear, wavy boundary.

A21—7 to 10 inches, dark grayish-brown (10YR 4/2) loam; weak, thin, platy structure; very friable; slightly acid; clear, smooth boundary.

A22—10 to 15 inches, dark grayish-brown (10YR 4/2) loam; moderate, thin, platy structure; very friable; slightly acid; clear, smooth boundary.

B1—15 to 17 inches, dark-brown (10YR 4/3) loam; weak, medium, subangular blocky structure; friable; slightly acid; abrupt, smooth boundary.

B21t—17 to 22 inches, dark-brown (10YR 4/3) heavy loam; moderate, fine, subangular blocky structure; firm; thin, patchy clay films; slightly acid; clear, smooth boundary.

B22t—22 to 26 inches, dark yellowish-brown (10YR 4/4) heavy loam containing slightly more clay than the B21t horizon; moderate, medium, subangular blocky structure; firm; medium acid; clear, smooth boundary.

B23t—26 to 30 inches, dark-brown (10YR 3/3 and 7.5YR 4/4) sandy clay loam; moderate, medium, angular blocky structure; firm; strongly acid; gradual, smooth boundary.
IIB3—30 to 33 inches, dark-brown (7.5YR 4/4) gravelly sandy loam; weak, coarse, subangular blocky structure; friable; medium acid; abrupt, smooth boundary.
IIC—33 to 48 inches +, dark-brown (7.5YR 4/4) gravelly sand; single grain; loose; medium acid.

When moist, the surface layer ranges from very dark brown (7.5YR 4/2) to very dark grayish brown (10YR 3/2) in color. When dry, the surface layer is light grayish brown (10YR 6/2). In places the texture of the surface layer is sandy loam instead of loam. The thickness of the solum ranges from 24 to 40 inches. The relative proportions of coarse sand and gravel are variable, but fine gravel is predominant. In some places where these soils occur in the northwestern part of the county, the substratum contains a layer of material that is more coherent than the gravelly sand and that ranges from sandy loam to sandy clay loam in texture.

Orion Series

The Orion series consists of somewhat poorly drained soils that formed in deep, silty alluvium derived from loess-mantled uplands. These soils have a light-colored surface layer, and their profile commonly contains a dark-colored, buried surface layer at a depth ranging from 18 to 42 inches. They are on broad flood plains of the major streams and on narrow bottoms along the smaller streams. The original vegetation consisted of plants, such as grasses, sedges, reeds, elms, and willows, that tolerate a large amount of water.

The Orion soils occur in areas similar to those occupied by the Arenzville soils, and the soils of these two series formed in about the same kind of material. The profile of the Orion soils is more mottled, however, than that of the Arenzville soils. The Orion soils have poorer drainage and greater textural stratification in their profile than the Chaseburg soils. Also unlike the profile of the Chaseburg soils, their profile contains a dark-colored, buried surface layer.

Representative profile of Orion silt loam in a cultivated field (SW¼NE¼ sec. 24, T. 26 N., R. 16 W., Pierce County, Wis.):

Ap—0 to 7 inches, very dark grayish-brown (10YR 3/2) silt loam; few, fine, distinct and prominent, dark-brown (7.5YR 4/4) and strong-brown (7.5YR 5/6) mottles; weak, medium, platy structure; friable; neutral reaction; abrupt, smooth boundary.
C—7 to 28 inches, dark-gray (10YR 4/1) silt loam; many, fine, distinct to prominent, dark-brown (7.5YR 4/4) and strong-brown (7.5YR 5/6) mottles; many spots of ferric hydroxide or manganese; weak, medium and thin, platy structure; friable; neutral reaction; gradual, smooth boundary.
A1b—28 to 40 inches, dark-brown (7.5YR 3/2) silt loam; many, fine, prominent, dark reddish-brown (5YR 3/3) mottles; weak, fine, subangular blocky structure; friable; slightly acid; gradual, smooth boundary.
Cb—40 to 48 inches +, dark grayish-brown (2.5Y 4/2) silt loam; common, fine, prominent, dark-brown (7.5YR 4/4) mottles; weak, medium, platy structure; friable; slightly acid.

In some places this soil is covered by a thin layer of sandy overwash. In others the profile contains thin layers of sand. Minor differences in color occur throughout the profile because of the various sources of the sediment. In some areas the surface layer, when moist, is dark grayish brown (10YR 4/2) instead of very dark grayish brown (10YR 3/2). The color ranges from light brownish gray (10YR 6/2) to light gray (10YR 4/1), when the soil material is dry. Depth to the buried surface layer (A1b horizon) ranges from 18 to 42 inches. In places the soil material between the Ap horizon and the buried surface layer consists of thin layers of silty material colored various shades of brown or gray. The color of the buried surface layer ranges from black to dark brown or very dark brown. Some variation occurs in the degree of mottling and in the amount of organic matter throughout the profile.

Ostrander Series

The Ostrander series is composed of well-drained soils that are nearly level to sloping. These soils have formed in a moderately shallow mantle of loess over calcareous glacial till of Iowan age. They are on uplands in the northwestern part of the county. The original vegetation was prairie grasses.

The Ostrander soils, like the Renova, have formed in a layer of silty material over glacial till. They have a thicker, darker colored surface layer, however, than the Renova soils. The Ostrander soils occur with Edith soils, but they differ from those soils in having formed in silty material over till instead of in leached, gravelly glacial drift. Where the till plains are adjacent to outwash plains, the Ostrander soils occur with Waukegan soils. Unlike the Waukegan soils, which are underlain by glacial outwash, the Ostrander soils are underlain by till.

Representative profile of Ostrander silt loam in a cultivated field, near the junction of a town road and State Highway No. 29 (NW¼NW¼ sec. 32, T. 27 N., R. 19 W., Pierce County, Wis.):

Ap—0 to 10 inches, very dark gray (10YR 3/1) silt loam; moderate, fine, granular structure; friable; neutral reaction; clear, irregular boundary.
B1—10 to 16 inches, dark-brown (10YR 3/3) silt loam; moderate, fine, subangular blocky structure; friable; neutral reaction; clear, smooth boundary.
B21t—16 to 20 inches, dark-brown (10YR 4/3) light silty clay loam; moderate, fine, subangular blocky structure; friable; thin, patchy clay films; slightly acid; clear, smooth boundary.
B22t—20 to 26 inches, dark yellowish-brown (10YR 4/4) heavy loam; moderate, medium, subangular blocky structure; firm; few dark-brown (7.5YR 4/4) coats on the surfaces of the peds; thin, patchy clay films; slightly acid; clear, smooth boundary.
B3—26 to 30 inches, dark-brown (10YR 4/3) heavy loam; weak, medium, subangular blocky structure; friable; few dark-brown (7.5YR 4/4) coats on the surfaces of the peds; slightly acid; clear, smooth boundary.
C—30 inches +, strong-brown (10YR 5/6 to 5/8) clay loam; massive; very firm; medium acid.

The surface layer is black (10YR 2/1) in areas that have not been cultivated, but the color ranges from very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2) in cultivated areas. The texture ranges from heavy silt loam to silty clay loam in the upper B horizons and from loam to sandy clay loam in the lower B horizons. The thickness of the layer of silty material over till ranges from 12 to 30 inches. The underlying calcareous till ranges from loam to clay loam in texture.

Otterholt Series

The Otterholt series consists of well-drained, gently sloping to moderately steep soils of the uplands. These soils have formed in a mantle of loess, 30 to 60 inches thick, over glacial till of Iowan age. The original vegetation was a deciduous forest consisting mainly of hard maple and basswood.

The Otterholt soils occur with the moderately well drained Spencer and somewhat poorly drained Almena soils, and they form a drainage sequence with those soils. They have a more thoroughly leached profile than the Seaton soils. Unlike the Seaton soils, they have a degraded B1 horizon, as indicated by the thick, bleached silt coats on the surfaces of the peds.

Representative profile of Otterholt silt loam in an area that has not been disturbed (NE¼NE¼NW¼ sec. 7, T. 27 N., R. 15 W., Pierce County, Wis.):

O—2 inches to 0, very dark grayish-brown (10YR 3/2) organic debris, partly decomposed and firmly matted by entwining roots; parts of plants and remains of insects can be identified under magnification; slightly acid.

A1—0 to 3 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, very fine, granular structure; very friable; slightly acid; clear, smooth boundary.

A21—3 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; weak, thin, platy structure; very friable; few very dark grayish-brown (10YR 3/2) discolorations, caused by organic matter, have been carried into this horizon from the A1 horizon by worms, burrowing animals, and insects; numerous very fine roots; slightly acid; clear, smooth boundary.

A22—7 to 10 inches, grayish-brown (10YR 5/2) silt loam; weak, thin, platy structure; friable; few, very fine, fibrous roots; strongly acid; gradual, smooth boundary.

A&B—10 to 15 inches, grayish-brown (10YR 5/2) and light brownish-gray (10YR 6/2) silt loam containing small patches of dark-brown (10YR 4/3) silt loam that appear to be remnants of a B2 horizon; weak, coarse, prismatic and weak, medium, platy structure but breaks, if disturbed, to weak, fine, subangular blocky and somewhat flaky; friable; few very fine, fibrous roots; strongly acid; gradual, smooth boundary.

B1—15 to 23 inches, dark-brown (10YR 4/3) silt loam; weak, coarse, prismatic and weak, medium to thick, platy structure but breaks, if disturbed, to moderate, medium, subangular blocky; most blocky peds have darker surfaces (10YR 3/3) and lighter colored interiors (10YR 4/3) than the other peds; vesicular; friable; few coarse roots; has patchy to continuous, bleached silt coats of light brownish gray (10YR 6/2) and pale brown (10YR 6/3) on the faces of some peds; silt coats are thickest and most nearly continuous along the vertical cleavage planes; few thin clay films on the faces of some blocky peds; very strongly acid; clear, smooth boundary.

B2t—23 to 33 inches, dark-brown (10YR 4/3) heavy silt loam; weak, medium, prismatic and weak, medium to thick, platy structure but breaks readily to moderate, medium, subangular blocky; vesicular; firm; few coarse roots; has thin, bleached silt coats on the faces of platy peds, but these are less numerous than in the B1 horizon; the clay films occur as thin, patchy discolorations on the faces of blocky peds within the body of the prisms; they are thicker and somewhat more continuous on the faces of the blocky and prismatic peds toward the lower boundary of the horizon than in the upper part; strongly acid; clear, smooth boundary.

B3—33 to 43 inches, dark-brown (10YR 4/3) silt loam; weak, coarse, prismatic and weak, medium, platy structure but breaks, if disturbed, to weak, medium, subangular blocky; friable; few coarse roots; peds in upper part of the horizon have thin, bleached silt coats; few, thin, patchy clay films along the primary vertical cleavage planes and in the continuous soil pores; strongly acid; diffuse, smooth boundary.

IIC1—43 to 53 inches, dark-brown (10YR 4/3) clay loam consisting of loess-influenced glacial till; generally structureless, but has some widely spaced, strongly developed, vertical cleavage planes along which are thin, patchy clay films; plastic when wet, hard when dry; strongly acid; clear, smooth boundary.

IIC2—53 to 55 inches, grayish-brown (2.5Y 5/2) clay loam to clay glacial till; generally structureless but has few widely spaced vertical cleavage planes along which are thick, continuous clay films; plastic when wet, very hard when dry; very strongly acid; abrupt, smooth boundary.

IIC3—55 to 67 inches, grayish-brown (10YR 5/2) to yellowish-brown (10YR 5/8) clay loam glacial till; generally structureless but has a few widely spaced, weakly developed vertical cleavage planes along which are a few thin clay films; plastic when wet, very hard when dry; strongly acid.

In cultivated areas the color of the surface layer ranges from very dark grayish brown (10YR 3/2) to grayish brown (10YR 5/2). In areas that have not been cultivated, the surface layer consists of a thin A1 horizon that bleached silt as a result of degradation, and a grayish-brown (10YR 3/2) in color. The thickness of the solum ranges from 32 to 48 inches. Depth to glacial till ranges from 30 to 60 inches.

In places most of the B1 horizon has been replaced by bleached silt as a result of degradation and a grayish-brown (10YR 5/2) A2 horizon, as much as 10 inches thick, has formed. Where degradation has occurred, an irregular boundary separates the A2 and B horizons in places, and tongues of soil material from the A2 horizon extend downward into the B1 horizon. The degree of development of the clay films in the B horizons is variable. The till that underlies these soils is yellowish brown (10YR 5/4) or brown (10YR 5/3) and ranges from loam to clay loam in texture. Except in a few small areas that have been influenced by local limestone, the till is acid.

Plainfield Series

The soils of the Plainfield series are deep, sandy, and exessively drained. They have a thin A horizon (generally less than 6 inches thick) underlain by C horizons that are normally coarse textured and that are medium acid to strongly acid. In most places the profile contains thin layers of loamy sand at a depth of about 3 feet. These soils have formed on stream terraces in deep, sandy outwash. The original vegetation was a forest of mixed hardwoods, mostly oaks.

The Plainfield soils occur mainly with Sparta soils, but they also occur with Dakota and Burkhardt soils. They have formed in the same kind of material as the Sparta soils, but they have a thinner, lighter colored surface layer than the Sparta soils. The Plainfield soils are lighter colored than the Dakota and Burkhardt soils, and they lack a textural B horizon that is typical in the profile of those soils. They lack a gravelly substratum like that underlying the Burkhardt soils.

Representative profile of Plainfield loamy sand (NW¼SW¼ sec. 34, T. 25 N., R. 16 W., Pierce County, Wis.):

A1—0 to 2 inches, very dark grayish-brown (10YR 3/2) loamy sand; structureless; very friable; medium acid; clear, smooth boundary.

AC—2 to 9 inches, dark-brown (10YR 4/3) loamy sand; structureless; loose; strongly acid; gradual boundary.
C1—9 to 20 inches, yellowish-brown (10YR 5/4) fine sand; structureless; loose; strongly acid; diffuse boundary.
C2—20 to 38 inches, light yellowish-brown (10YR 6/4) fine sand; structureless; loose; strongly acid; diffuse boundary.
C3—38 to 48 inches, light yellowish-brown (10YR 6/4) fine sand but contains thin layers of slightly coherent, dark-brown loamy sand; structureless; loose; strongly acid; gradual boundary.
C4—48 inches +, light yellowish-brown (10YR 6/4) fine sand; structureless; loose; strongly acid.

The surface layer is very dark grayish brown (10YR 3/2) or dark grayish brown (10YR 4/2) when moist, but it is generally light brownish gray (10YR 6/2) when dry. Variations in color are common, however, as a result of mixing of the surface soil by wind. The thickness of the surface layer ranges from about 4 inches, in eroded areas, to about 15 inches, in uneroded areas.

Port Byron Series

The soils of the Port Byron series are silty and well drained. They have formed in a deep mantle of coarse-textured loess on uplands in the northwestern part of the county. These soils are nearly level to sloping. The original vegetation was prairie grasses.

The Port Byron soils occur with Ostrander soils. Unlike those soils, they have a thick (more than 12 inches) layer of coarse silty material in the lower part of their profile. The Port Byron and Seaton soils formed in similar material, but the Port Byron soils have a dark-colored surface layer unlike that of the Seaton soils. The Port Byron soils occur on outwash plains with Waukegan soils, but they differ from those soils in having formed in coarse-textured loess instead of in sandy outwash.

Representative profile of Port Byron silt loam in a cultivated field (SE¼SE¼ sec. 3, T. 26 N., R. 20 W., Pierce County, Wis.):

Ap—0 to 9 inches, very dark brown (10YR 2/2) silt loam; weak, fine, subangular blocky structure; friable; neutral; clear, smooth boundary.
B1—9 to 16 inches, very dark brown (10YR 2/2) silt loam; weak, fine, subangular blocky structure; friable; medium acid; clear, smooth boundary.
B21—16 to 21 inches, dark-brown (10YR 4/3) silt loam; weak to moderate, fine, subangular blocky structure; friable; very dark grayish-brown (10YR 3/2) and dark-brown (10YR 3/3) stains from organic matter on the faces of the peds; medium acid; clear, smooth boundary.
B22—21 to 28 inches, dark-brown (10YR 4/3) silt loam that is finer textured than the B21 or B3 horizons; weak to moderate, fine, subangular blocky structure; friable; dark-brown stains from organic matter on the faces of the peds; medium acid; clear, smooth boundary.
B3—28 to 38 inches, dark-brown (10YR 4/3) coarse silt; weak, medium, subangular blocky structure; friable; few dark-brown (10YR 3/3) stains from organic matter on the vertical cleavage planes of the peds; medium acid; gradual, smooth boundary.
C—38 to 50 inches, dark-brown (10YR 4/3) coarse silt; weak, medium, platy structure; friable; medium acid.
R—50 inches +, fissured dolomite.

In areas that have not been cultivated, the color of the surface layer ranges from black (10YR 2/1) to very dark brown (10YR 2/2). The texture of the surface layer is normally a coarse silt loam. Near Prescott, however, where these soils occur with Lamont soils, the texture of the surface layer ranges to very fine sandy loam. The thickness of the solum ranges from 28 to 40 inches. In the B horizons that contain the maximum amount of clay, the content of clay ranges from 18 to 24 percent.

Racine Series

The Racine series consists of soils that are well drained. These soils have formed in a moderately shallow layer of loess over glacial till. They are nearly level to sloping and are on glacial till plains. In some places these soils have formed in a transitional zone between areas of forest and areas of grassland. In others they have formed in areas of forest where there were scattered openings made up of grassland.

The Racine soils formed in about the same kind of material as the Renova and Ostrander soils. They occur with Edith soils, which were derived from glacial drift of variable texture. Unlike those soils, however, they have formed in a mantle of silty material over glacial till.

Representative profile of Racine silt loam in a cultivated field (SW¼SE¼ sec. 7, T. 26 N., R. 19 W., Pierce County, Wis.):

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, fine, granular structure; friable; neutral reaction; clear, smooth boundary.
A12—8 to 10 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, thick, platy structure; friable; neutral reaction; clear, smooth boundary.
A2—10 to 11 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, thick, platy structure; friable; dark-brown (10YR 3/3) stains from organic matter on the vertical faces of the peds; slightly acid; clear, smooth boundary.
B1—11 to 13 inches, dark-brown (10YR 4/3) silt loam; weak, thick, platy structure breaking to moderate, fine, subangular blocky; friable; dark-brown (10YR 3/3) stains from organic matter on the faces of the peds; slightly acid; clear, smooth boundary.
B21t—13 to 16 inches, dark-brown (10YR 4/3) heavy silt loam; moderate, fine, subangular blocky structure; firm; few dark-brown (10YR 3/3) stains from organic matter on the faces of the peds; slightly acid; gradual, smooth boundary.
B22t—16 to 22 inches, dark-brown (10YR 4/3) heavy silt loam; moderate, fine to medium, subangular blocky structure; firm; few dark-brown (10YR 3/3) stains from organic matter on the faces of the peds; slightly acid; gradual, smooth boundary.
B31—22 to 26 inches, dark-brown (10YR 4/3) silt loam; moderate to weak, medium, subangular blocky structure; firm; slightly acid; clear, smooth boundary.
IIB32—26 to 30 inches, dark yellowish-brown (10YR 4/4) clay loam; moderate, coarse, angular blocky structure; very firm; sand grains on the faces of the peds; slightly acid; gradual, smooth boundary.
IIC—30 inches +, dark yellowish-brown (10YR 4/4) clay loam; massive; medium acid.

The thickness of the surface layer ranges from about 6 inches in eroded areas to 13 inches in areas that have not been cultivated and that are not eroded. In cultivated areas the color of the surface layer is very dark brown (10YR 2/2) or very dark grayish brown (10YR 3/2). In areas that have not been cultivated, the color is very dark brown (10YR 2/2) or black (10YR 2/1). The thickness of the layer of silty material over till ranges from 12 to 30 inches, and the thickness of the solum ranges from 24 to 36 inches. In places the texture of the underlying glacial till is loam instead of clay loam.

Renova Series

The Renova series consists of soils that are well drained. These soils have formed in a moderately shal-

low layer of silty loess over glacial till of Iowan age. They are nearly level to moderately steep and occur on glacial till plains, mainly in the northern half of the county. The original vegetation was mixed hardwoods.

The Renova soils occur with Vlasaty, Sargeant, and Otterholt soils. They form a drainage sequence with the moderately well drained Vlasaty and the somewhat poorly drained Sargeant soils, and they formed in similar material. They have somewhat thinner horizons than the Otterholt soils.

Representative profile of Renova silt loam in an area that has not been cultivated (NE¼NE¼ sec. 7, T. 27 N., R. 16 W., Pierce County, Wis.):

A1—0 to 3 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, very fine, subangular blocky structure; friable; some mixing by worms of soil material from this and the A2 horizon at the lower boundary of this horizon; slightly acid; clear, wavy boundary.

A21—3 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; very dark grayish-brown (10YR 3/2) tongues of organic material extend into this horizon from the A1 horizon; weak, very thin, platy structure; friable; slightly acid; clear, smooth boundary.

A22—7 to 10 inches, dark grayish-brown (10YR 4/2) silt loam; weak, very thin, platy structure; very friable; slightly acid; clear, smooth boundary.

B1—10 to 17 inches, dark-brown (10YR 4/3) silt loam; moderate, fine, subangular blocky structure but breaks, if disturbed, to weak, thin to medium, platy structure; friable; medium acid; clear, smooth boundary.

B21t—17 to 20 inches, dark-brown (10YR 4/3) heavy silt loam; moderate, medium, subangular blocky structure that breaks, if disturbed, to weak, medium to thick, platy structure; firm; thin, patchy clay films; strongly acid; clear, smooth boundary.

IIB22t—20 to 26 inches, dark yellowish-brown (10YR 4/4) sandy loam glacial till that apparently has been strongly washed; weak, medium, angular blocky structure; firm; thin, patchy clay films; thin pebble and cobble line along the upper boundary of the horizon; medium acid; clear, smooth boundary.

IIB23—26 to 32 inches, dark yellowish-brown (10YR 4/4) clay loam glacial till; moderate, coarse, prismatic structure but breaks, if disturbed, to moderate, coarse, angular blocky structure; thick, washed sand coats along the vertical faces of the structural peds; firm; strongly acid; gradual, smooth boundary.

IIB3—32 to 46 inches, dark yellowish-brown (10YR 4/4) clay loam glacial till; weak, coarse, prismatic structure but breaks, under pressure, to weak, coarse, angular blocky structure; dark-brown (10YR 3/3) clay films on the faces of the peds; the clay films are thickest and most continuous along vertical cleavages; firm; medium acid; gradual, smooth boundary.

IIC—46 inches +, dark yellowish-brown (10YR 4/4) and yellowish-brown (10YR 5/6) clay loam glacial till; massive or generally weak, medium, platy structure; firm; slightly acid.

The Renova soils vary mainly in the thickness of the cap of silty material over glacial till. This cap ranges from 12 to 30 inches in thickness. Also, the surface layer is very dark grayish brown (10YR 3/2) in places instead of dark grayish brown (10YR 4/2). The thickness of the surface layer ranges from less than 4 inches in eroded areas to 13 inches in areas that are not eroded. In places the texture of the till is loam instead of clay loam. In some areas a layer of sandy loam, a few inches thick, lies between the glacial till and the layer of silty material.

Renova Series, Sandy Variants

The variants of the Renova series are well drained. They have formed on ridgetops in two-storied material consisting of an upper story of sandy loam and a lower story of loamy glacial till. These soils are gently sloping to moderately steep. The original vegetation was a forest of mixed hardwoods.

These soils occur with Renova, Whalan, and Dubuque soils. Unlike these associated soils, however, which have a silty or loamy solum, they have a moderately coarse texture in the upper part of the solum. Also, dolomite bedrock is at a depth greater than 42 inches instead of within a depth of 42 inches, as in the Whalan and Dubuque soils.

Representative profile of a sandy variant of Renova fine sandy loam in a cultivated field (NW¼NE¼ sec. 27, T. 25 N., R. 16 W., Pierce County, Wis.):

Ap—0 to 8 inches, very dark grayish-brown (10YR 4/2) fine sandy loam; weak, fine, granular structure; friable when moist; medium acid; clear, smooth boundary.

A2—8 to 16 inches, dark-brown (10YR 4/3) fine sandy loam; weak, medium, subangular blocky structure; friable; medium acid; clear, smooth boundary.

B21t—16 to 22 inches, dark yellowish-brown (10YR 4/4) heavy fine sandy loam; moderate, medium, subangular blocky structure; firm; medium acid; clear, smooth boundary.

IIB22t—22 to 28 inches, dark-brown (7.5YR 4/4) sandy clay loam; moderate, medium, subangular blocky structure; firm; strongly acid; gradual, smooth boundary.

IIB23t—28 to 42 inches, dark-brown (7.5YR 4/4) light clay loam; moderate, medium, subangular blocky structure; firm; thin, patchy clay films; strongly acid; gradual, smooth boundary.

IIC—42 to 48 inches, dark-brown (7.5YR 3/4) heavy clay loam; strong, medium, angular blocky structure; very hard; slightly acid; clear, smooth boundary.

R—48 inches +, fissured dolomite.

In many places the color of the surface layer is dark grayish brown (10YR 4/2) instead of very dark grayish brown (10YR 3/2). The texture of the surface layer ranges from fine sandy loam to loamy fine sand. Thickness of the sandy loam upper story ranges from 12 to 30 inches. The texture of the glacial till in the substratum ranges from loam to clay loam. The thickness of the solum ranges from 26 to 42 inches.

Rockton Series

The soils of the Rockton series are well drained. They have formed in 20 to 36 inches of loamy material that is underlain by fissured dolomite or by material weathered from dolomite. These soils are nearly level to moderately steep. They are in broad valleys in the northwestern part of the county. The original vegetation was prairie grasses.

The Rockton soils occur with Dakota soils. Unlike those soils, however, which are underlain by sandy outwash, they are underlain by dolomite or by material weathered from dolomite. The Rockton soils lack the silty solum and the substratum of sandy outwash that are typical of the Waukegan soils.

Representative profile of Rockton loam in a cultivated field, about 750 feet down a farm road and about 200 feet south of the road (SE¼SW¼ sec. 30, T. 27 N., R. 19 W., Pierce County, Wis.):

Ap—0 to 7 inches, black (10YR 2/1) loam; moderate, fine, crumb structure; friable; slightly acid; abrupt, smooth boundary.

A1—7 to 12 inches, black (10YR 2/1) loam; moderate, fine, crumb structure; friable; many root channels; numerous

worm casts and krotovinas; slightly acid; clear, smooth boundary.

A3—12 to 17 inches, dark-brown (10YR 3/3) loam; weak, medium, subangular blocky structure; friable; numerous root channels, worm casts, and krotovinas; slightly acid; clear, smooth boundary.

B1—17 to 25 inches, dark yellowish-brown (10YR 4/4) loam that is slightly finer textured than that in the A3 horizon; weak, medium, subangular blocky structure; friable; few root channels and worm casts; slightly acid; clear, smooth boundary.

B2t—25 to 31 inches, dark-brown (7.5YR 3/4) heavy loam; weak, coarse, subangular blocky structure; friable; few root channels and krotovinas; thin, patchy clay films; slightly acid; abrupt, wavy boundary.

IIR—31 inches +, partly weathered fissured dolomite.

The soils of the Rockton series vary mainly in depth over dolomite or clayey material weathered from dolomite and in the amount of material weathered from dolomite in the profile. The solum ranges from 20 to 36 inches in thickness. Where the profile contains material weathered from dolomite, the lower part of the solum formed in that material. Where these soils occur on outwash plains in the western part of the county, the layer of clayey material weathered from dolomite is generally very thin or is absent. This layer is normally thicker, or as much as 12 inches thick, where this soil occurs in broad valleys in the northwestern part of the county. In many places the color of the surface layer is very dark brown (10YR 2/2), but the color ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2). In general the texture of the surface layer ranges from sandy loam to loam, but it is silt loam in a few places.

Rozetta Series

The Rozetta series consists of moderately well drained soils that have formed in deep, alluvial, silty material. These soils are nearly level or gently sloping and occur on stream terraces. The original vegetation was a forest of mixed hardwoods.

The Rozetta soils form a drainage sequence with the well-drained Fayette and the somewhat poorly drained Stronghurst soils, and they formed in similar material. They occur with Arenzville soils, but they have formed in older deposits of silty material than those soils. Also, they have a textural B horizon that is lacking in the Arenzville soils.

Representative profile of Rozetta silt loam in a cultivated field (SE¼SW¼ sec. 2, T. 24 N., R. 15 W., Pierce County, Wis.):

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, very fine, granular structure; friable; medium acid; clear, smooth boundary.

A2—8 to 12 inches, grayish-brown (10YR 5/2) silt loam; weak, thin, platy structure; friable; light-gray (10YR 7/2) silt coats on the horizontal faces of the peds; medium acid; clear, smooth boundary.

B1—12 to 17 inches, brown (10YR 5/3) silt loam; weak, fine, subangular blocky structure; friable; silt coats on the horizontal faces of the peds; medium acid; clear, smooth boundary.

B21t—17 to 21 inches, dark-brown (10YR 4/3) silt loam; few, fine, distinct, dark-brown (7.5YR 4/4) to strong-brown (7.5YR 5/8) mottles; weak, thick, platy structure in place, breaking to moderate, very fine, subangular blocky; friable; strongly acid; clear, smooth boundary.

B22t—21 to 31 inches, dark-brown (10YR 4/3) heavy silt loam; few, fine, distinct, dark-brown (7.5YR 4/4) to strong-brown (7.5YR 5/8) mottles; weak, thick, platy structure in place, breaking to strong, fine, subangular blocky; friable; silt coats and a few thin clay films on the horizontal faces of the peds; many, fine, dark manganese stains; very strongly acid; clear, smooth boundary.

B3—31 to 42 inches, dark-brown (10YR 4/3) silt loam; many, fine, distinct, dark-brown (7.5YR 4/4) to strong-brown (7.5YR 5/8) mottles; weak, thick, platy structure in place, breaking to moderate, fine, angular blocky; very friable; silt coats on the horizontal faces of the peds; strongly acid; clear, smooth boundary.

C—42 inches +, dark-brown (10YR 4/3) silt loam; few, fine, distinct, dark-brown (7.5YR 4/4) mottles; weak, thick, platy structure; very friable; strongly acid.

The color of the surface layer is generally dark grayish brown (10YR 4/2), but it is very dark grayish brown (10YR 3/2) or dark gray (10YR 4/1) in places. The depth at which mottling begins ranges from 18 to 30 inches. The degree of mottling in the lower part of the profile varies slightly. The thickness of the solum ranges from 32 to 42 inches. In places this soil is underlain by sand at a depth greater than 42 inches.

Sable Series

The Sable series is composed of deep, very poorly drained soils that have formed in loess. These soils occur in nearly level areas or in slight depressions on loess-mantled uplands. The original vegetation was grasses and sedges that tolerate a large amount of water.

The Sable soils occur with the well drained Otterholt, the moderately well drained Spencer, and the somewhat poorly drained Almena soils. To a lesser extent, they occur with moderately well drained Vlasaty and somewhat poorly drained Sargeant soils. Like the soils with which they occur, the Sable soils formed in a deep layer of loess over glacial till. Their solum is deeper over till, however, than those of the Vlasaty and Sargeant soils. The Sable soils have a thicker, darker colored surface layer than any of the associated soils.

Representative profile of Sable silt loam in a pastured draw:

A1—0 to 10 inches, black (10YR 2/1) silt loam; moderate, fine, granular structure; friable; mildly alkaline; abrupt, smooth boundary.

B1g—10 to 20 inches, olive-gray (5Y 5/2) heavy silt loam; dark grayish-brown (2.5Y 4/2) stains from organic matter and a few, fine, prominent, yellowish-brown (10YR 5/6) mottles; moderately alkaline; gradual, smooth boundary.

B2g—20 to 30 inches, olive-gray (5Y 5/2) heavy silt loam; common, fine, prominent, yellowish-brown (10YR 5/6) mottles; moderate, medium, subangular blocky structure; firm; moderately alkaline; gradual, smooth boundary.

Cg—30 to 48 inches, olive-gray (5Y 5/2) heavy silt loam; mottling same as that in the B2g horizon; massive; moderately alkaline; gradual, smooth boundary.

IIC2g—48 inches +, grayish-brown (10YR 5/2) gritty silty clay loam; many, medium, prominent, brown (7.5YR 5/4) mottles; massive; strongly alkaline.

In places the color of the surface layer is very dark gray (10YR 3/1) instead of black (10YR 2/1). The surface layer ranges from 6 inches to as much as 18 inches in thickness. In many places a few inches of silty material has been deposited on the surface. Also, a layer as much as a few inches thick covers the surface in some places. The color of the subsoil ranges from dark brown (10YR 4/3) to olive (5Y 4/4) or olive gray (5Y 5/2), but the color is olive in the wettest areas. The underlying glacial till ranges from loam to clay loam in texture. The color of the substratum ranges from grayish brown (10YR 5/2) to gray (10YR 5/1).

Santiago Series

The Santiago series consists of well-drained soils that have formed in 12 to 30 inches of windblown silt (loess) over glacial till. These are gently sloping to sloping soils on ridgetops in the northern part of the county. They are characterized by an intermingling of the A2 and B2 horizons, or by the penetration of the A2 horizon into the B2 horizon as tongues or thick coatings on the surfaces of the peds. The original vegetation was mixed hardwoods.

In most places the Santiago soils are adjacent to moderately well drained Freeon and somewhat poorly drained Freer soils. Unlike the Renova soils, which are underlain by yellowish-brown heavy loam to clay loam till, the Santiago soils are underlain by reddish-brown till that has a texture of sandy loam.

Representative profile of Santiago silt loam in a cultivated field (SE¼NW¼ sec. 2, T. 27 N., R. 18 W., Pierce County, Wis.):

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, subangular blocky structure; very friable; slightly acid; clear, smooth boundary.

A2—8 to 12 inches, grayish-brown (10YR 5/2) silt loam; moderate, thin, platy structure; very friable; medium acid; clear, irregular boundary.

B&A—12 to 15 inches, dark grayish-brown (10YR 4/2) tongues of silt loam that have weak, medium, platy structure, mixed with dark-brown (10YR 4/3) silt loam that has fine, subangular blocky structure; friable; very strongly acid; clear, wavy boundary.

B21t—15 to 20 inches, dark-brown (10YR 4/3) silt loam; weak, coarse, prismatic structure but breaks to moderate, medium, subangular blocky structure; friable; structural peds thickly coated with bleached silt; very strongly acid; clear, wavy boundary.

IIB22t—20 to 26 inches, reddish-brown (5YR 4/4) heavy loam; moderate and weak, coarse, prismatic structure but breaks to coarse, angular blocky structure; firm; continuous clay films are thickest on the vertical faces of the peds; very strongly acid; clear, smooth boundary.

IIB3—26 to 33 inches, dark-brown (7.5YR 4/4) loam; weak, coarse, angular blocky structure; firm; thin, continuous clay films on the primary vertical cleavage planes; strongly acid; clear, smooth boundary.

IIC—33 to 48 inches +, dark-brown (7.5YR 4/4) sandy clay loam showing weak, thick, platy structure; medium acid.

In cultivated areas the color of the surface layer is mainly dark grayish brown (10YR 4/2), but it ranges to very dark grayish brown (10YR 3/2) in places. The thickness of the solum ranges from 26 to 38 inches. The underlying till ranges from loam to sandy loam or sandy clay loam in texture and from dark brown (7.5YR 4/4) to reddish brown (5YR 4/4) in color. In places glacial cobbles or stones are on the surface or throughout the profile. The depth to which tongues of material from the A2 horizon extend into the B2 horizon ranges from 0 to 3 or 4 inches.

Sargeant Series

The Sargeant series is composed of soils that are somewhat poorly drained. These soils have formed in 12 to 30 inches of windblown silt (loess) over glacial till. They are nearly level to sloping and occur on glacial till plains in the uplands. The original vegetation was mixed hardwoods.

The Sargeant soils are members of the drainage sequence that includes the well drained Renova, the moderately well drained Vlasaty, the poorly drained Auburndale, and the very poorly drained Clyde soils. They occur with the Renova, Vlasaty, and Auburndale soils.

Representative profile of Sargeant silt loam in a permanent pasture (SE¼NE¼ sec. 18, T. 26 N., R. 16 W., Pierce County, Wis.):

Ap—0 to 4 inches, very dark gray (10YR 3/1) silt loam; moderate, medium, granular structure; friable; slightly acid; abrupt, smooth boundary.

A21—4 to 7 inches, grayish-brown (10YR 5/2) silt loam; many brown (10YR 5/3) to yellowish-brown (10YR 5/6) mottles; moderate, thin and medium, platy structure; very friable; strongly acid; abrupt, smooth boundary.

A22—7 to 11 inches, brown (10YR 5/3) silt loam; many grayish-brown (10YR 5/2) to yellowish-brown (10YR 5/6) mottles; moderate, thin and medium, platy structure; friable; very strongly acid; abrupt, smooth boundary.

B1—11 to 16 inches, brown (10YR 5/3) heavy silt loam; many dark yellowish-brown (10YR 4/4) and grayish brown (10YR 5/2) mottles; moderate, medium, subangular blocky structure; firm; light yellowish-brown (10YR 6/4), bleached silt coats on the surfaces of the peds; very strongly acid; clear, irregular boundary.

IIB21t—16 to 21 inches, yellowish-brown (10YR 5/6) clay loam; many grayish-brown (10YR 5/2) to yellowish-brown (10YR 5/8) mottles; moderate to strong, medium, angular blocky structure; plastic when wet, hard when dry; light yellowish-brown (10YR 6/4) silt coats on the surfaces of the peds; thin, patchy clay films; very strongly acid; clear, irregular boundary.

IIB22t—21 to 28 inches, yellowish-brown (10YR 5/6) clay loam; moderate, medium, prismatic structure breaking to strong, medium, subangular blocky; plastic when wet, hard when dry; dark-gray (10YR 4/1) to grayish-brown (10YR 5/2), bleached silt coats on the surfaces of the peds; thin, patchy clay films; strongly acid; clear, smooth boundary.

IIB3—28 to 35 inches, yellowish-brown (10YR 5/4) clay loam; many light brownish-gray (10YR 6/2) and strong-brown (7.5YR 5/6) mottles; moderate, medium, angular blocky structure; plastic when wet, hard when dry; strongly acid; clear, smooth boundary.

IIC—35 to 42 inches +, brown (10YR 5/3) to yellowish-brown (10YR 5/4) clay loam; common grayish-brown (2.5Y 5/2) to light olive-brown (2.5Y 5/4) mottles; massive; plastic; medium acid.

The surface layer ranges from dark gray (10YR 4/1) to very dark grayish brown (10YR 3/2) in color. The thickness of the mantle of silty material ranges from 12 to 30 inches. The thickness of the subsoil ranges from 15 to 32 inches, and the thickness of the solum ranges from 24 to 40 inches. The underlying glacial till ranges from loam to clay loam in texture and from grayish brown (10YR 5/2) to olive brown (2.5Y 4/4) or yellowish brown (10YR 5/4) in color. The reaction ranges from slightly acid to very strongly acid.

Schapville Series

The Schapville series consists of moderately well drained or well drained, sloping to steep soils of the uplands. These soils have formed in a thin to moderately thick deposit of loess over slightly acid to calcareous, olive-gray shale. Their B horizons have developed partly in loess and partly in material weathered from shale. The original vegetation was prairie grasses.

The Schapville soils occur with wet subsoil variants of the Schapville series. They also occur with Derinda soils, but they have a thicker, darker colored surface layer than those soils. The Schapville soils have a thicker, darker colored surface layer than the Dubuque and Whalan

soils. Unlike the Dubuque and Whalan soils, which are underlain by limestone, they are underlain by shale.

Representative profile of Schapville silt loam in a pasture (NE¼SE¼ sec. 18, T. 27 N., R. 17 W., Pierce County, Wis.):

A11—0 to 6 inches, black (10YR 2/1) silt loam; weak, fine, granular structure; friable; slightly acid; clear, smooth boundary.

A12—6 to 9 inches, black (10YR 2/1) silt loam; moderate, medium, granular structure; friable; slightly acid; gradual, smooth boundary.

A3—9 to 12 inches, very dark gray (10YR 3/1) silt loam; weak, very fine, subangular blocky structure; friable; slightly acid; clear, smooth boundary.

B21t—12 to 16 inches, very dark grayish-brown (10YR 3/2) heavy silt loam; weak, medium, subangular blocky structure; firm; medium acid; clear, smooth boundary.

B22t—16 to 23 inches, brown (10YR 5/3) silty clay loam; few, fine, faint, dark-brown (10YR 4/3) mottles; moderate, medium, angular blocky structure; very firm; abundant, thick, very dark brown (10YR 2/2) clay films on the faces of the peds; medium acid; clear, smooth boundary.

IIB23—23 to 27 inches, olive-gray (5Y 4/2) silty clay loam; common, medium, distinct, dark-brown (10YR 4/3) mottles; moderate, medium, angular blocky structure; very firm; abundant, thick, very dark brown (10YR 2/2) clay films on the faces of the peds; medium acid; abrupt, smooth boundary.

IIC1—27 to 29 inches, olive-gray (5Y 4/2) silty clay weathered from shale; many, medium, distinct, yellowish-brown (10YR 5/6) mottles; massive; very firm; neutral reaction; abrupt, smooth boundary.

IIC2—29 inches +, olive-gray (5Y 4/2) silty clay shale; has many, fine, distinct, yellowish-brown (10YR 5/6) mottles in the upper part; strong, thick, platy structure; hard when dry, plastic when wet; weakly alkaline.

In eroded areas the color of the surface layer ranges from black (10YR 2/1) to very dark brown (10YR 2/2). In places mottling occurs only in the substratum of weathered shale. The thickness of the mantle of silty material ranges from 10 to 30 inches. In some areas fragments of chert and pebbles of glacial origin lie between the layer of loessal material and the material weathered from shale.

Schapville Series, Wet Subsoil Variants

Wet subsoil variants of the Schapville series are somewhat poorly drained and are gently sloping. They have formed in a thin to moderately thick layer of loess over material weathered from slightly acid to calcareous shale. Their B horizon has developed partly in the loess and partly in material weathered from shale. These soils receive seepage from the adjacent higher lying soils that formed in loess, in glacial material, or in material weathered from limestone. The original vegetation was trees and grasses that tolerate a large amount of water.

The wet subsoil variants of the Schapville series have poorer internal drainage than the Schapville soils, which are well drained or moderately well drained. Also unlike the Schapville soils, they have an A2 horizon. They have poorer drainage and have a thicker, darker colored surface layer than the Whalan and Dubuque soils. In addition they developed over shale rather than limestone. These wet subsoil variants occur with Derinda soils, but they have a thicker, darker colored surface layer than those soils.

Representative profile of Schapville silt loam, wet subsoil variant, in a cultivated field (N½NE¼ sec. 2, T. 27 N., R. 18 W., Pierce County, Wis.):

Ap—0 to 9 inches, black (10YR 2/1) silt loam; weak, medium, granular structure; friable; neutral reaction; abrupt, smooth boundary.

A2—9 to 12 inches, dark grayish-brown (10YR 4/2) silt loam; few, fine, distinct, yellowish-brown (10YR 5/4) mottles; moderate, thin, platy structure; friable; neutral reaction; abrupt, smooth boundary.

B1—12 to 14 inches, brown (10YR 5/3) heavy silt loam; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; moderate, fine, subangular blocky structure; firm; medium acid; abrupt, smooth boundary.

B21t—14 to 18 inches, brown (10YR 5/3) heavy silt loam; few, fine, faint, grayish-brown (10YR 5/2) and yellowish-brown (10YR 5/4) mottles; strong, fine, angular blocky structure; firm; slightly acid; abrupt, smooth boundary.

B22t—18 to 21 inches, brown (10YR 5/3) silty clay loam; common, fine, distinct, grayish-brown (10YR 5/2) and yellowish-brown (10YR 5/6) mottles; strong, fine, angular blocky structure; firm; slightly acid; abrupt, smooth boundary.

IIB23tg—21 to 23 inches, olive (5Y 5/4) silty clay weathered from shale; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; strong, medium, angular blocky structure; sticky when wet; contains a few pebbles and fragments of chert; slightly acid; abrupt, smooth boundary.

IICg—23 inches +, olive (5Y 4/3) silty clay; common, medium, distinct, strong-brown (7.5YR 5/6) mottles; massive; very sticky when wet; slightly acid; abrupt, smooth boundary.

The thickness of the layer of silty material ranges from 10 to 30 inches. In places mottling is more intensive in the upper B horizons than shown in the profile described. In some areas a thin gravel or chert line lies between the silty material and the clayey material weathered from the shale. The color of the shale substratum ranges from greenish gray to olive.

Seaton Series

The Seaton series is composed of deep, well-drained soils that are silty and that are gently sloping to steep. These soils have formed in deep (more than 42 inches thick) deposits of silty loess on upland ridges, valley slopes, and rolling uplands. In Pierce County they are generally underlain by fissured dolomite or sandstone at a depth of 50 inches or more. The original vegetation was a forest of mixed hardwoods.

The Seaton soils occur with soils of the Downs and Dubuque series. They have formed in darker colored silty material than the Downs soils and have formed in a deeper layer of silty material than the Dubuque, which formed in material less than 42 inches thick. On valley slopes the Seaton soils also occur with soils of the Gale series. Unlike the Gale soils, which formed in a thin layer of windblown silt over sandstone, they formed in a deep deposit of silty material over dolomite or sandstone.

Representative profile of Seaton silt loam in a woodlot (SE¼NW¼ sec. 14, T. 26 N., R. 15 W., Pierce County, Wis.):

A1—0 to 3 inches, very dark brown (10YR 2/2) silt loam; weak, fine, granular structure; very friable; slightly acid; abrupt, smooth boundary.

A21—3 to 6 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, thin, platy structure; very friable; slightly acid; clear, smooth boundary.

A22—6 to 10 inches, brown (10YR 5/3) silt loam; moderate, medium to thin, platy structure; few widely spaced patches that have a dark-brown (10YR 4/3) color on a background of brown (10YR 5/3) distinguish the remnants of an undegraded B horizon; very thin, light-gray

(10YR 7/2), bleached silt coats on the plates and on occasional weakly developed cleavage planes; friable; slightly acid; gradual, smooth boundary.

B1—10 to 15 inches, dark-brown (10YR 4/3) silt loam; weak, medium, platy structure but breaks, if disturbed, to moderate, fine, subangular blocky structure; patchy, thin, bleached silt coats on the major cleavage planes; dark yellowish-brown (10YR 3/4) coats and a few thin clay films; friable; slightly acid to medium acid; clear, smooth boundary.

B21t—15 to 23 inches, dark-brown (10YR 4/3) heavy silt loam; moderate, medium, platy structure but breaks readily to moderate, fine, subangular blocky structure; few, thin, bleached silt coats on the faces of some peds; most peds have continuous, thin clay films on all faces, but the clay films are most prominent along the vertical cleavage planes; friable to firm; very strongly acid; clear, smooth boundary.

B22t—23 to 33 inches, dark-brown (10YR 4/3) heavy silt loam; weak, medium, platy structure but breaks, if disturbed, to moderate, medium, subangular blocky structure; thin, patchy clay films on the faces of the peds; clay films are most prominent along the vertical structural cleavage planes; friable; very strongly acid; gradual, smooth boundary.

B3—33 to 44 inches, dark-brown (10YR 4/3) silt loam; weak, coarse, subangular blocky structure but displays a generally weak, medium platiness throughout; thin, patchy clay films (fewer in number than in the B22t horizon) on the faces of the peds along vertical cleavage planes; continuous clay films in worm holes and in root cavities; friable; strongly acid; gradual, smooth boundary.

C1—44 to 58 inches, dark-brown (10YR 4/3) silt loam; weak, medium, platy structure; worm holes have clay linings; friable; strongly acid; gradual, smooth boundary.

C2—58 to 70 inches, dark-brown (10YR 4/3) silt loam; weak, medium, platy structure; friable; strongly acid; diffuse, smooth boundary.

C3—70 inches +, dark-brown (10YR 4/3) to yellowish-brown (10YR 5/4) silt loam; generally has weak, thin, platy structure; very friable; strongly acid at a depth of 70 inches, but only slightly acid at a depth of 108 inches.

In areas that have not been cultivated, the color of the surface layer ranges from very dark brown (10YR 2/2) to black (10YR 2/1). The color of the surface layer is very dark grayish brown (10YR 3/2) or dark grayish brown (10YR 4/2), however, in areas that have been cultivated. The content of clay in the B horizons ranges from 18 to 24 percent. The solum ranges from 30 to 48 inches in thickness. Fissured dolomite or sandstone bedrock is generally at a depth of 50 inches or more, but it is at a depth of 42 to 50 inches in some small areas.

Sogn Series

The Sogn series is made up of dark-colored silt loams that are well drained. These soils are generally steep or are near breaks of steep slopes. They are shallow over dolomite. In many places dark reddish-brown clay is in the cracks in the underlying dolomite. In Pierce County the areas of Sogn soils are so intermingled with areas of Rockton soils that it was not feasible to map the soils of the two series separately.

Representative profile of Sogn silt loam in Iowa County, Wis.:

A1—0 to 10 inches, black (10YR 2/1) heavy silt loam; moderate, fine, granular structure; friable; many roots; few fragments of chert and dolomite; neutral; abrupt boundary.

R—10 inches +, fractured dolomite.

Bedrock is generally at a depth of less than 12 inches, but it is at a depth of as much as 20 inches in some areas. In places stones are on the surface and throughout the soil profile.

Sparta Series

The Sparta series consists of deep soils that are excessively drained. These soils have formed in deep, sandy outwash that was derived partly from sandstone and partly from glacial outwash. They are on broad terraces of the Mississippi and St. Croix Rivers and of the South Fork of the Kinnickinnick River near River Falls. The original vegetation was prairie grasses.

The Sparta soils occur with Plainfield soils, and they formed in similar material. They have a darker color than the Plainfield soils, however, and they formed under grasses instead of under forest. The Sparta soils also occur with Dakota and Burkhardt soils. Their profile is somewhat similar to that of the Dakota soils, but it is coarser textured and lacks a B horizon. The Sparta soils are coarser textured than the Burkhardt soils, and they lack a B horizon that is typical in the profile of the Burkhardt soils. Also, they lack gravelly material in the subsoil and substratum.

Representative profile of Sparta loamy sand (SW¼SW¼ sec. 35, T. 25 N., R. 18 W., Pierce County, Wis.):

Ap—0 to 7 inches, very dark brown (10YR 2/2) loamy sand; weak, fine, crumb structure; very friable; medium acid; clear, smooth boundary.

A12—7 to 17 inches, very dark brown (10YR 2/2) loamy sand; weak, medium, subangular blocky structure; very friable; medium acid; diffuse, smooth boundary.

C1—17 to 34 inches, dark-brown (10YR 4/3) fine sand; single grain; loose; medium acid; diffuse, smooth boundary.

C2—34 to 50 inches, dark-brown (10YR 4/3) and yellowish-brown (10YR 5/4) fine sand; single grain; loose; medium acid; diffuse, smooth boundary.

C3—50 to 60 inches +, yellowish-brown (10YR 5/4) fine sand; single grain; loose; medium acid.

In places the color of the surface layer is black (10YR 2/1) instead of very dark brown (10YR 2/2). The color ranges to very dark grayish brown (10YR 3/2) in areas that are eroded or that have an accumulation of lighter colored soil material that has been blown onto the surface by wind. In places the profile contains a few pebbles.

Spencer Series

The Spencer series consists of soils that are moderately well drained. These soils have formed on uplands in a thick mantle of acid silty loess over loam or sandy loam glacial till that is also acid. They are nearly level to sloping. The original vegetation was a deciduous forest consisting mainly of maple and basswood.

The Spencer soils form a drainage sequence with well-drained Otterholt, somewhat poorly drained Almena, and poorly drained Auburndale soils. They have a profile somewhat similar to that of the Vlasaty soils, but they formed in a mantle of silty loess 30 to 60 inches thick instead of in a mantle of silty material 12 to 30 inches thick. Also, unlike the Vlasaty soils, which have B horizons that formed partly in glacial till, the Spencer soils have B horizons that formed entirely in silty loess.

Representative profile of Spencer silt loam in a cultivated field, approximately 3½ miles northwest of Plum City (N½NW¼ sec. 7, T. 25 N., R. 15 W., Pierce County, Wis.):

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable; mildly alkaline; clear, smooth boundary.

A2—8 to 10 inches, grayish-brown (10YR 5/2) silt loam; moderate, thin, platy structure; friable; medium acid; abrupt, smooth boundary.

A&B—10 to 16 inches, dark-brown (10YR 3/3) heavy silt loam; weak, thick, platy structure breaking to moderate, fine, subangular blocky structure; thick silt coats on the vertical and horizontal faces of the structural peds; contains small patches of strong-brown silt loam that appear to be remnants of a B2 horizon; firm; medium acid; clear, smooth boundary.

B2t—16 to 27 inches, dark grayish-brown (10YR 4/2) heavy silt loam; few, fine, prominent, strong-brown (7.5YR 5/6) mottles; thick, platy structure breaking to moderate, fine, subangular blocky structure; thin patchy, clay films and thick silt coats on the horizontal and vertical faces of the peds; firm; very strongly acid; clear, smooth boundary.

B3—27 to 37 inches, dark grayish-brown (10YR 4/3) silt loam; few, fine, prominent, strong-brown (7.5YR 5/6) mottles; weak, medium, subangular blocky structure; a few silt coats and patchy clay films on the vertical faces of the structural peds; friable; very strongly acid; clear, smooth boundary.

C1—37 to 44 inches, grayish-brown (10YR 5/2) silt loam; common, fine, prominent, yellowish-brown (10YR 5/6) mottles; massive or weak, thick, platy structure; very strongly acid; gradual, smooth boundary.

C2—44 inches +, reddish-brown (5YR 4/4) to yellowish-brown (10YR 5/8) sandy clay loam till; few, fine, prominent, strong-brown (7.5YR 5/8) mottles; massive; slightly acid.

The thickness of the mantle of loess over glacial till ranges from 30 to 60 inches. In areas that are cultivated, the surface layer, when moist, ranges from dark grayish brown (10YR 4/2) to grayish brown (10YR 5/2). In areas that have not been disturbed, the surface layer consists of a thin A1 horizon. In those areas the color of the A1 horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2) when the soil material is moist, but the color has a value of 6 when dry. The shape, size, and grade of the structural peds vary only slightly within similar horizons at different sites. The variations are wide, however, in the thickness of the solum, the thickness of the bleached silt coats on the faces of the peds, and in the degree of development of the clay films within the B horizons. The texture of the till substratum ranges from loam to sandy clay loam.

Stronghurst Series

The Stronghurst series consists of deep, nearly level soils that are somewhat poorly drained. These soils have formed in silty loess under a forest of mixed hardwoods. They are on stream terraces.

The Stronghurst soils occur with well drained Fayette and moderately well drained Rozetta soils. They formed in the same kind of material as those soils and form a drainage sequence with them. The Stronghurst soils also occur with Arenzville soils, which formed in recently deposited alluvium. They formed in older alluvium than the Arenzville soils. Also unlike those soils, they have an alluvial horizon of clay accumulation in their profile.

Representative profile of Stronghurst silt loam, benches, in a cultivated field (SE¼SW¼ sec. 10, T. 25 N., R. 15 W., Pierce County, Wis.):

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, subangular blocky structure; friable; neutral reaction; abrupt, smooth boundary.

A2—7 to 9 inches, brown (10YR 5/3) silt loam; many, medium, distinct, dark-brown (7.5YR 4/4) and strong-brown (7.5YR 5/6) mottles; moderate, thin, platy structure; very friable; neutral reaction; abrupt, smooth boundary.

B1—9 to 11 inches, dark-brown (10YR 4/3) silt loam; many, medium, prominent, yellowish-red (5YR 4/6) mottles; weak, medium, subangular blocky structure that exhibits very weakly expressed, thin plates; friable; slightly acid; abrupt, smooth boundary.

B21t—11 to 15 inches, dark-brown (10YR 4/3) heavy silt loam; many, medium, prominent, yellowish-red (5YR 4/6) mottles; moderate, medium, platy structure but breaks, if disturbed, to moderate, very fine, angular blocky (flaky) structure; firm; thin, patchy clay films; slightly acid; clear, smooth boundary.

B22t—15 to 22 inches, dark-brown (10YR 4/3) heavy silt loam; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, coarse, prismatic structure but breaks, if disturbed, to moderate, medium, angular blocky (flaky) structure that displays a generally weak, thick platiness throughout; firm; thin, patchy clay films; strongly acid; clear, smooth boundary.

B23—22 to 27 inches, dark-brown (10YR 4/3) heavy silt loam; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, coarse, prismatic structure but breaks, if disturbed, to moderate, medium and coarse, angular blocky (flaky) structure; the angular blocky structure, in turn, displays a generally weak, thick platiness throughout; firm; thin, patchy, brown (10YR 5/3), bleached silt coats on the faces of the peds; thin, patchy clay films; strongly acid; clear, smooth boundary.

B3—27 to 38 inches, dark-brown (10YR 4/3) and dark yellowish-brown (10YR 4/4) silt loam; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, coarse, prismatic structure but breaks, under pressure, to weak, coarse, angular blocky structure; the angular blocky structure, in turn, displays a generally weak, thick platiness throughout; thin, patchy clay films on the vertical faces of the structural peds; strongly acid; gradual, smooth boundary.

C—38 to 60 inches, dark-brown (10YR 4/3) and brown (10YR 5/3) silt loam; many, medium, prominent, strong-brown (7.5YR 5/6) mottles; weak, thick, platy structure; friable; medium acid.

The surface layer ranges from dark gray (10YR 4/1) to dark grayish brown (10YR 4/2) in color and from 9 to 15 inches in thickness. The subsoil ranges from dark brown (10YR 4/3) to grayish brown (10YR 5/2) in color. It is more grayish in the areas where drainage is the poorest. Mottling extends to within a few inches of the surface in some places, and it is absent from the upper part of the profile in others. The thickness of the silty material in which this soil formed ranges from 42 inches to several feet over sand. In some areas sand is below a depth of 3½ feet.

Tell Series

The Tell series consists of well-drained soils that are nearly level or gently sloping. These soils have formed on stream terraces in 24 to 42 inches of windblown silt (loess) over stratified sandy outwash. The lower part of their solum developed in the sandy outwash. The original vegetation was mixed hardwoods.

The Tell soils occur with Fayette and Meridian soils. Their solum is shallower than that of the Fayette soils and finer textured than that of the Meridian soils. Their profile resembles that of the Antigo soils, except that it does not contain a gravelly substratum.

Representative profile of Tell silt loam in a cultivated field (SW¼SE¼ sec. 35, T. 25 N., R. 15 W., Pierce County, Wis.):

Ap—0 to 6 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, very fine, subangular blocky structure; friable; neutral reaction; abrupt, smooth boundary.

A21—6 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; weakly expressed tongues of soil material that are discolored by organic matter extend into this horizon from the Ap horizon; weak, thin, platy structure; friable; neutral reaction; abrupt, smooth boundary.

A22—9 to 12 inches, dark grayish-brown (10YR 4/2) silt loam; dark-brown (10YR 4/3) worm casts scattered throughout the horizon; moderate, thin, platy structure; very friable; slightly vesicular; neutral reaction; abrupt, smooth boundary.

B1—12 to 14 inches, dark-brown (10YR 4/3) and dark grayish-brown (10YR 4/2) silt loam; moderate, fine, subangular blocky structure but breaks, under pressure, to weak, medium, platy structure; friable; neutral reaction; abrupt, smooth boundary.

B21t—14 to 17 inches, dark-brown (10YR 4/3) heavy silt loam; moderate, fine, angular blocky structure; firm; slightly acid; clear, smooth boundary.

B22t—17 to 21 inches, dark-brown (10YR 4/3) heavy silt loam; moderate, fine to medium, angular blocky structure; firm; few, thin, patchy, dark-brown (10YR 3/3) clay films on the faces of the peds; strongly acid; clear, smooth boundary.

B23—21 to 25 inches, dark yellowish-brown (10YR 4/4) heavy silt loam; moderate to strong, medium, angular blocky structure; firm; many, thin, patchy, dark-brown (10YR 3/3) clay films on the faces of the peds; strongly acid; abrupt, smooth boundary.

IIB3—25 to 27 inches, dark-brown (10YR 3/3) to dark yellowish-brown (10YR 3/4) loam; weak, medium, angular blocky structure that displays a few strongly developed, vertical cleavage planes; firm; nearly continuous, dark-brown (7.5YR 3/2) clay films along primary vertical cleavages; strongly acid; clear, smooth boundary.

IIC—27 to 36 inches, yellowish-brown (10YR 5/4) fine sand; single grain; loose; medium acid.

The surface layer is generally very dark grayish brown (10YR 3/2), but the color ranges to dark brown (10YR 3/3) and is dark grayish brown (10YR 4/2) in places. The thickness of the solum ranges from 26 to 36 inches. In most places the substratum consists of stratified fine sand, but it contains some fine gravel or a pebble line in some places. In many places where these soils occur in the broad valleys or on the outwash plain in the northwestern part of the county, the substratum has a texture of sandy loam to sandy clay loam.

Terril Series

The Terril series consists of deep, well drained or moderately well drained soils that are nearly level or gently sloping. These soils have formed in dark-colored sediments that are medium textured. They are on the flood plains of small streams. The original vegetation was mainly prairie grasses.

The Terril soils occur with areas of Alluvial land and with well-drained Dakota and Waukegan soils. The material in which they formed was generally deposited less recently than the material that makes up the areas of Alluvial land. Furthermore, their profile lacks the contrasting layers of sand, gravel, and stones that are present in the areas of Alluvial land. The Terril soils have formed in more recent alluvial sediments than the Dakota and Waukegan soils. Also, they occur on flood plains instead of on the older alluvial terraces.

Representative profile of Terril loam in a cultivated field, about 50 feet west of a road (NE¼SW¼ sec. 6, T. 26 N., R. 18 W., Pierce County, Wis.):

Ap—0 to 10 inches, very dark brown (10YR 2/2) loam; strong, fine, granular structure; friable; medium acid; clear, smooth boundary.

A11—10 to 16 inches, very dark brown (10YR 2/2) loam; moderate, very fine, granular structure; firm; slightly porous; medium acid; clear, smooth boundary.

C1—16 to 25 inches, very dark brown (10YR 2/2) loam; weak, medium, subangular blocky structure; friable; highly porous; medium acid; clear, smooth boundary.

C2—25 to 45 inches, very dark brown (10YR 2/2) silt loam; weak, medium, subangular blocky structure; firm; slightly porous; thin, bleached silt coats on the surfaces of the peds; medium acid; clear, smooth boundary.

C3—45 to 50 inches, dark-brown (10YR 4/3) heavy loam; massive; firm; medium acid.

The surface layer ranges from black (10YR 2/1) to very dark brown (10YR 2/2) in color and from 14 to 45 inches in thickness. The substratum ranges from black (10YR 2/1) to dark brown (10YR 3/3) in color, and it contains faint mottles. In some areas the profile contains the surface layer of an older buried soil at a depth between 18 and 42 inches. A thin overwash of sandy material covers the surface in some places. The degree of layering is highly variable within the profile. In some places the profile contains thin layers of sand.

Vlasaty Series

The Vlasaty series consists of moderately well drained soils that are nearly level to sloping. These soils are on glacial till plains, where they formed in a moderately shallow layer of loess over glacial till (fig. 16). The original vegetation was mixed hardwoods.

The Vlasaty soils occur with well-drained Renova and somewhat poorly drained Sargeant soils. They form a drainage sequence with those soils, and they have developed in the same kind of material. The Vlasaty soils also occur with Ostrander soils. They are less well drained than those soils, however, and they have a lighter colored, thinner surface layer.

Representative profile of Vlasaty silt loam in a cultivated field (SW¼NE¼ sec. 8, T. 26 N., R. 17 W., Pierce County, Wis.):

Ap—0 to 8 inches, dark-gray (10YR 4/1) silt loam; moderate, fine, granular structure; friable; neutral reaction; abrupt, smooth boundary.

A2—8 to 12 inches, brown (10YR 5/3) coarse silt loam; few, fine, faint, yellowish-brown (10YR 5/6) mottles in the lower part; moderate, medium, platy structure; very friable; light brownish-gray (10YR 6/2) silt coats on the surfaces of the peds; medium acid; abrupt, wavy boundary.

B1—12 to 16 inches, dark yellowish-brown (10YR 4/4) light silty clay loam; many, fine, faint, grayish-brown (10YR 5/2) and yellowish-brown (10YR 5/6) mottles; moderate, fine, subangular blocky structure; friable; few clay films and many very dark brown stains from organic matter on the surfaces of the peds; very strongly acid; clear, smooth boundary.

IIB21t—16 to 20 inches, dark yellowish-brown (10YR 4/4) clay loam; many, fine, faint, grayish-brown (10YR 5/2) and yellowish-brown (10YR 5/6) mottles; moderate to strong, medium, subangular blocky structure; plastic when wet, hard when dry; clay films and stains from organic matter more pronounced than in the B1 horizon; light brownish-gray (10YR 6/2) silt coats on the surfaces of some of the peds; very strongly acid; clear, wavy boundary.

IIB22t—20 to 29 inches, dark yellowish-brown (10YR 3/4) clay loam; many, fine, distinct, grayish-brown (10YR 5/2) and yellowish-brown (10YR 5/6) mottles; moderate to strong, medium, angular blocky structure; plastic

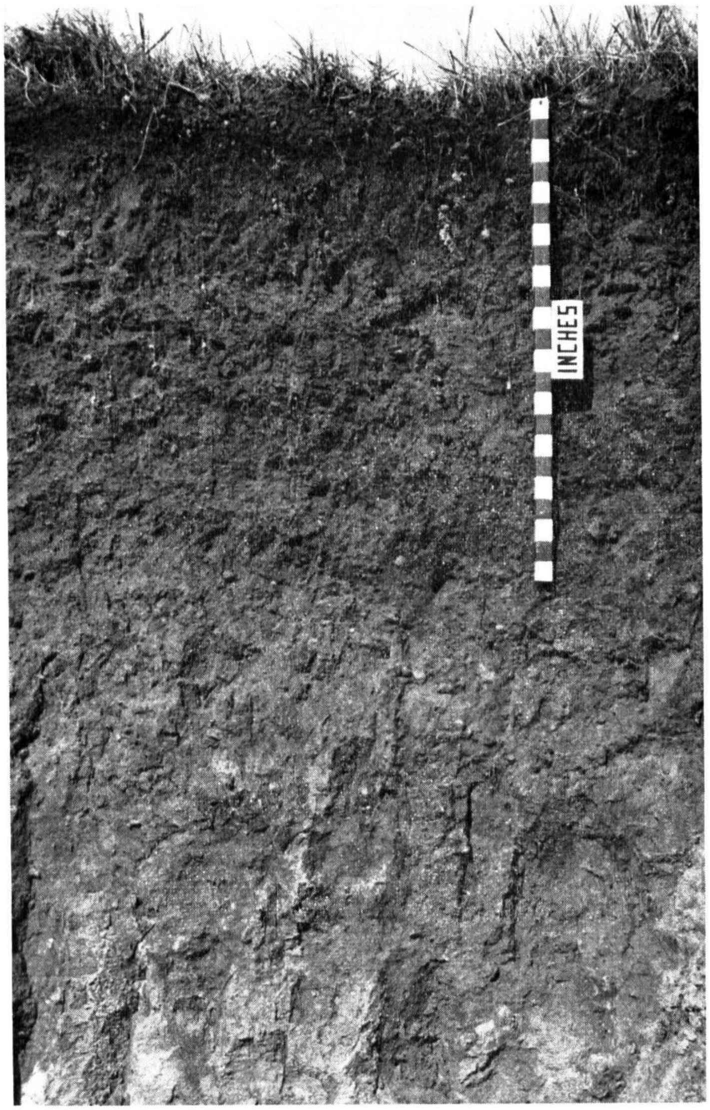

Figure 16.—**Profile of Vlasaty silt loam.**

when wet, hard when dry; dark-gray (10YR 4/1) stains from organic matter and clay films on the surfaces of the peds; very strongly acid; gradual, irregular boundary.

IIB3—29 to 42 inches, dark yellowish-brown (10YR 4/4) clay loam; many, medium, distinct, multicolored mottles; moderate, medium to coarse, angular blocky structure; plastic when wet, hard when dry; clay films prominent; some dark grayish-brown (10YR 4/2) stains from organic matter; very strongly acid; gradual, irregular boundary.

IIC—42 to 58 inches, yellowish-brown (10YR 5/4) to grayish-brown (2.5Y 5/2) clay loam till; massive; plastic; medium acid.

In areas that have been cultivated, the color of the surface layer ranges from dark gray (10YR 4/1) to dark grayish brown (10YR 4/2). In areas that have not been disturbed, the color of the surface layer ranges from very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2). The mottling varies in degree and in intensity. In places mottling is absent from the A2 horizon and the upper part of the subsoil. The thickness of the layer of silty material over glacial till ranges from 12 to 30 inches. The thickness of the solum ranges from 28 to 42 inches. The till ranges from loam to clay loam in texture and from grayish brown (2.5Y 5/2) to yellowish brown (10YR 5/6) in color.

Waukegan Series

The Waukegan series consists of moderately deep, well-drained soils that are nearly level or gently sloping. These soils have formed on stream terraces in silty loess over stratified sandy outwash. The original vegetation was prairie grasses.

The Waukegan soils occur with Port Byron and Dakota soils. Unlike the Port Byron soils, which formed in deep, coarse-textured silt, they formed in moderately deep, silty loess. Their depth over washout is about the same as that of the Dakota soils, but they have a silty solum rather than a loamy solum like the Dakota soils. The Waukegan soils have formed in the same kind of material as the Tell soils, but they have a thicker, darker colored surface layer than those soils.

Representative profile of Waukegan silt loam in a cultivated field (SW¼SW¼ sec. 31, T. 25 N., R. 17 W., Pierce County, Wis.):

Ap—0 to 7 inches, black (10YR 2/1) silt loam; weak, fine, granular structure; very friable; neutral reaction; clear, smooth boundary.

A12—7 to 13 inches, very dark brown (10YR 2/2) silt loam; weak, very fine, subangular blocky structure; friable; a few, thin (15 to 30 millimeters in diameter), vertical, black (10YR 2/1) tongues of soil material that have been discolored by organic matter extend into this horizon from the Ap horizon; medium acid; clear, smooth boundary.

A3—13 to 15 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, fine, subangular blocky structure; friable; medium acid; abrupt, smooth boundary.

B1—15 to 18 inches, dark-brown (10YR 4/3) silt loam; weak, medium, subangular blocky structure; friable; medium acid; clear, smooth boundary.

B2t—18 to 28 inches, dark-brown (10YR 4/3) heavy silt loam; moderate, medium, subangular blocky structure; few, thin, patchy, bleached silt coats on the faces of the peds; friable; thin, patchy clay films; medium acid; clear, smooth boundary.

IIB—28 to 34 inches, dark-brown (10YR 4/3) sandy loam; weak, coarse, subangular blocky structure; friable; medium acid; clear, smooth boundary.

IIC—34 to 60 inches, yellowish-brown (10YR 5/4) fine sand; single grain; loose; medium acid.

In general, the color of the surface layer is black (10YR 2/1) to very dark gray (10YR 3/1) or very dark brown (10YR 2/2). In some areas, however, the color of the surface layer is very dark grayish brown (10YR 3/2). The thickness of the solum ranges from 24 to 42 inches. The texture of the substratum is generally between a fine sand and coarse sand. In small included areas, the substratum contains fine pebbles.

Whalan Series

The Whalan series consists of soils that formed in a layer of silty loess over glacial till. The till, in turn, is underlain by material weathered from dolomite or by fissured dolomite. The Whalan soils are well drained and are gently sloping to moderately steep. Their solum is thicker than 20 inches over bedrock. The original vegetation was mixed hardwoods.

The areas of Whalan soils are adjacent to areas of Dubuque soils and to areas of Renova and other soils formed in glacial till. Unlike the Dubuque soils, they have a layer of glacial till between the silty surface layer

and the bedrock. The Whalan soils differ from the Renova soils in being underlain by dolomite bedrock at a depth of 42 inches or less.

Representative profile of Whalan silt loam in a woodlot (SW¼SE¼ sec. 27, T. 27 N., R. 20 W., Pierce County, Wis.):

A1—0 to 5 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, fine, granular structure; friable; neutral reaction; clear, smooth boundary.

A2—5 to 10 inches, dark grayish-brown (10YR 4/2) silt loam; weak, thin, platy structure; friable; slightly acid; clear, smooth boundary.

B21t—10 to 15 inches, dark-brown (10YR 4/3) silty clay loam; moderate, medium, subangular blocky structure; firm; thin, continuous clay films; slightly acid; clear, smooth boundary.

B22t—15 to 20 inches, dark-brown (10YR 4/3) silty clay loam; moderate, fine, subangular blocky structure; firm; thin, patchy clay films; neutral; clear, smooth boundary.

B23t—20 to 27 inches, dark-brown (10YR 4/3) silty clay loam; moderate, medium, subangular blocky structure; firm; thin clay films on the horizontal and vertical faces of the peds; few igneous pebbles along the lower boundary of the horizon; neutral reaction; clear, smooth boundary.

IIB3—27 to 29 inches, dark-brown (7.5YR 4/4) heavy sandy clay loam; weak, coarse, subangular blocky structure; firm; thin clay films on the horizontal faces of the peds; contains fragments of dolomite; neutral reaction; clear, smooth boundary.

IIIR—29 inches +, yellowish-brown (10YR 5/6), fine-textured, thinly bedded, fissured dolomite.

In places the color of the surface layer is dark grayish brown (10YR 4/2) instead of very dark grayish brown (10YR 3/2). The thickness of the layer of till ranges from 20 to 30 inches. In general, the layer of till ranges from loam to clay loam in texture, but thin layers of gravelly loamy sand are included in places. In places the profile contains a layer of material weathered from dolomite, but that layer is very thin or is absent in other places. Depth to bedrock ranges from 24 to 36 inches.

Worthen Series

The Worthen series consists of soils that are well drained or moderately well drained. These soils have formed in deep, dark-colored, silty alluvium and colluvium that have been moved down from the loess-mantled uplands by water erosion or soil creep. They are in small areas in draws, at the ends of draws, and at the base of foot slopes occupied by steeper soils. The original vegetation was prairie grasses.

The Worthen soils occupy positions similar to those occupied by the Chaseburg soils, but they are darker colored than those soils. The material in which they formed is similar to that in which the Terril soils formed, but it is less well sorted. The Worthen soils lack the textural B horizon that is typical in the profile of the Ostrander and Port Byron soils of the uplands.

Representative profile of Worthen silt loam (NE¼ NW¼ sec. 2, T. 27 N., R. 17 W., Pierce County, Wis.):

Ap—0 to 7 inches, very dark brown (10YR 2/2) silt loam; weak, fine, subangular blocky structure; very friable; neutral reaction; abrupt, smooth boundary.

A1—7 to 16 inches, very dark brown (10YR 2/2) silt loam; weak, medium, platy structure breaking to weak, very fine and fine, subangular blocky structure; friable; neutral reaction; clear, smooth boundary.

C1—16 to 27 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, thick, platy structure breaking to weak, fine, subangular blocky structure; very friable; medium acid; clear, smooth boundary.

C2—27 inches +, dark grayish-brown (10YR 4/2) silt loam; weak, very thick, platy structure breaking to weak, medium, subangular blocky structure; friable; strongly acid.

The color of the A horizons ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2) or very dark brown (10YR 2/2). The combined thickness of the A horizons ranges from 12 to 26 inches. In places a thin layer of sandy overwash and pebbles or small stones covers the surface. In some places the profile contains thin layers of fine sand. These soils are generally well drained and are free of mottles, but a few mottles occur below a depth of 18 inches in some places.

Wykoff Series

The Wykoff series consists of soils that are well drained and that are moderately shallow over glacial till. These soils have formed on upland glacial till plains in a mantle of silty loess over stratified glacial till. They are gently sloping to moderately steep. The original vegetation was mixed hardwoods.

The Wykoff soils occur with Renova and Vlasaty soils. Their profile is somewhat similar to those of the Renova and Vlasaty soils, but the lower part of their solum developed in sandy and gravelly drift rather than in clay loam drift. Also, the Wykoff soils are better drained than the Vlasaty soils.

Representative profile of a cultivated Wykoff loam in a field about 150 feet west of U. S. Highway No. 63 and 50 feet south of a fence (SE¼NE¼ sec. 3, T. 26 N., R. 17 W., Pierce County, Wis.):

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) loam; weak, very fine, granular structure; friable; slightly acid; abrupt, smooth boundary.

A2—8 to 9 inches, brown (10YR 5/3) loam; weak, thin, platy structure; friable; slightly acid; clear, smooth boundary.

B1—9 to 12 inches, dark yellowish-brown (10YR 4/4) loam; weak, medium, platy structure breaking to moderate, very fine, subangular blocky structure; friable; thin, light-gray (10YR 7/2) silt coats on the faces of the peds; slightly acid; clear, smooth boundary.

B21t—12 to 15 inches, dark-brown (10YR 4/3) loam; moderate, fine, subangular blocky structure; firm; thin, discontinuous, dark-brown (10YR 4/3) clay films on the surfaces of the peds; slightly acid; clear, smooth boundary.

B22t—15 to 23 inches, dark-brown (7.5YR 4/4) gravelly loam; moderate, medium, subangular blocky structure; firm; thin, discontinuous, dark-brown (7.5YR 3/4) clay films on the surfaces of the peds, in root channels, and in stone pockets; medium acid; clear, smooth boundary.

B3—23 to 30 inches, reddish-brown (5YR 4/4) gravelly sandy loam; weak, medium, subangular blocky structure; friable; medium acid; clear, smooth boundary.

C—30 to 42 inches, dark-brown (7.5YR 4/4), stratified gravelly loam and sandy loam; single grain; loose; medium acid.

The surface layer ranges from very dark brown (10YR 2/2) to dark grayish brown (10YR 4/2) in color and from silt loam to loam in texture. The solum ranges from 23 to 40 inches in thickness. The texture of the stratified underlying material ranges from gravelly loamy sand to clayey gravel. The underlying glacial drift ranges from yellowish brown (10YR 5/6) to dark brown (10YR 4/3) in color. In places the substratum contains a layer of soil material that is reddish brown (5YR 4/3).

Climate[7]

Table 8, compiled from records of the U. S. Weather Bureau at River Falls, gives climatic data that are generally typical for the climate of Pierce County. The figures for temperatures are not exactly typical for all the county, however, for the gently rolling area where the Weather Bureau station is located is in the valley of the Kinnickinnic River. For temperatures on the slopes and tops of hills, minor adjustments are needed to arrive at figures that are typical. This is because cold air collects in the valleys and causes the minimum temperatures to be lower than on the slopes. Daily and annual ranges in temperatures are greater in the valleys than on the slopes. The temperatures on the slopes tend to be moderate.

Table 8 also gives temperatures in terms of degree days (*3*). The number of degree days is the difference between the average temperature for a given day and 65° F. It is a measure of the amount of heat needed to keep the temperature on a specific day at 65°. For example, on a day having an average temperature of 50°, 15 degree days would be counted. A knowledge of the accumulated degree days for a stated time is helpful in calculating the amount of fuel needed for heating buildings and for determining the rate of growth and the maturity date of crops.

The climate of Pierce County is continental. Winters are long and snowy, and many of them are severely cold. The summers are warm, and they usually include several short periods in which the weather is excessively hot and humid. Temperatures in winter vary about twice as much as temperatures in summer. Spring and fall are often short, and the temperatures and precipitation during those seasons are composites of the temperatures and precipitation both of summer and winter. Changes in the weather can be expected every few days from late in fall through spring, but the weather is most unstable early in spring. In this county all of the climatic features tend toward extremes. The area is influenced by the succession of high and low pressure systems that move across the country from west to east.

Temperatures in this county not only vary considerably from season to season, but also from year to year. During the period 1931 to 1961, for example, the number of days when the temperature reached 90° or higher ranged from 34 in 1936 to zero in 1951. The number of days when the temperature was zero or lower ranged from 58 in 1936 to 8 in 1931.

The crops grown in this county generally receive enough moisture to grow well. About 65 percent of the annual rainfall normally comes during the months of May through September, when the main crops are grown. Most of the precipitation in winter is in the form of snow. In summer the probability of receiving 1 inch or more of rainfall during a 7-day period is greatest during the last 3 weeks of June. During that period, the probability is that 4 years in 10 a total of 1 inch or more of rainfall will be received during a 7-day period. The driest parts of summer are the last parts of July and August. During those periods, the probability is that only a trace or less of moisture will be received during a 7-day period in nearly 2 years in 10.

Table 9 gives the probabilities of the last freezing temperatures in spring and the first in fall. Because of the location of the Weather Bureau station in River Falls, however, the data are more nearly representative of the valleys than of areas at higher elevations. At the higher elevations, the probable date on which freezing temperatures will occur in spring is 2 or 3 days earlier

[7] By MARVIN W. BURLEY, State climatologist for Wisconsin, Weather Bureau, U.S. Department of Commerce.

TABLE 8.—*Temperatures and precipitation for Pierce County, Wis.*

[All data from records kept at River Falls, Wis., elevation 900 feet]

Month	Temperature				Average degree days	Precipitation			
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with—			Average total	One year in 10 will have—		Average snowfall
			Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—			Less than—	More than—	
	° F.	*° F.*	*° F.*	*° F.*	*Number*	*Inches*	*Inches*	*Inches*	*Inches*
January	23.1	2.8	40	−22	1,610	0.92	0.20	1.74	24.8
February	27.1	5.7	42	−19	1,360	.85	.16	1.56	16.0
March	37.5	18.6	56	−6	1,140	1.74	.64	3.13	35.1
April	55.6	33.6	75	20	610	2.36	.93	4.08	11.7
May	68.7	45.9	84	33	280	3.78	1.38	5.76	2.5
June	77.9	55.9	90	42	80	4.85	2.61	8.44	0
July	83.6	60.3	95	49	30	3.88	1.32	6.38	0
August	81.2	58.4	92	44	30	3.39	1.25	6.03	0
September	71.7	49.2	87	35	190	3.15	.78	6.46	.4
October	60.1	38.3	77	24	490	1.95	.48	3.77	4.5
November	40.7	23.4	61	2	990	1.63	.68	3.15	18.5
December	28.2	10.2	43	−13	1,420	1.07	.26	1.99	27.3
Year	54.6	33.5			8,230	29.57			35.1

than in the valleys. Also, at the higher elevations the probable date of the first freezing temperature in fall is 2 or 3 days later than in the valleys. As a result, the growing season [8] is about a week longer in areas at higher elevations than it is in the valleys. At River Falls, for example, the average date of the latest temperature of 32° or lower in spring is May 14. The average date of the first temperature of 32° or lower in fall is September 26. As a result, the length of the average growing season is 135 days, as compared to about 139 to 141 days in areas at the higher elevation.

During the growing season, the average number of growing-degree-day units, above a threshold temperature of 40°, is 3,600. Above a threshold temperature of 45°, it is 3,000, and above a threshold temperature of 50°, it is 2,300. Growing-degree-days are based on the concept that plant growth and insect development begin at the time certain critical temperatures are reached, and that the amount of plant growth or insect development is roughly proportional to the number of accumulated degree days. The number of growing-degree-days is computed by subtracting the daily average temperature from a chosen threshold. The most common temperature thresholds used are 40 to 50 degrees. An average temperature of 60 degrees, for example, is 20 degrees above a base of 40 degrees, 15 degrees above a base of 45 degrees, and 10 degrees above a base of 50 degrees. On days in which the average temperature is the same or lower than the threshold temperature, the number of growing-degree-days is zero.

About once in 2 years, intensive rainfall occurs in this county at the rate of 1.1 inches in 30 minutes, 1.4 inches in 1 hour, 1.75 inches in 3 hours, 2.1 inches in 6 hours, 2.5 inches in 12 hours, and 2.8 inches in 24 hours. The greatest amount of rainfall measured in 24 hours is 4.3 inches. That amount fell in River Falls on September 1, 1942, and again on June 24, 1951. About 0.01 inch or more precipitation is received, on the average, on 112 days during the year, but that amount of precipitation has been received between 100 and 124 days in 2 years out of 3.

The amount of snowfall varies widely. The amount has ranged from only 16 inches, received during the winter of 1930–31, to 84 inches, received during the winter of 1950–52. The average date of the first snowfall of 1 inch or more is November 15. It is probable that 1 inch of snow will fall by October 24 in 1 year in 10, and by December 7 in 9 years in 10. The probable length of time that snow will cover the ground to a depth of 1 inch or more is 20 percent of the time in November, 70 percent in December, 90 percent in January and February, 50 percent in March, and 5 percent in April. Snow to a depth of 10 inches or more can be expected 10 percent of the time in December, 20 percent of the time in January, 40 percent of the time in February, and 15 percent of the time in March.

Occasionally, violent thunderstorms occur in summer, and these are accompanied by heavy rain, strong winds, and hail. Thunderstorms occur on an average of 40 days a year, but the number of days they occur in individual years ranges from 23 to 58 days. Hail has fallen on an average of 2 days a year, but no hail has fallen in some years, and hail has fallen on as many as 7 days in other years. Since 1916, six tornadoes have passed through this county.

Records of wind, sunshine, and relative humidity are not available for Pierce County. However, the following data taken from records kept at Minneapolis, are representative for this county.

Prevailing winds are from the northwest from November through April, and from the southeast during the rest of the year. The strongest winds blow in April, when the average windspeed is 13 miles per hour. The months of July and August are the least windy. During those months, the average windspeed is 9 miles per hour. On the average, windspeed is less than 4 miles per hour about 10 percent of the time, 4 to 12 miles per hour 55 percent of the time, 13 to 31 miles per hour 35 percent of the time, and greater than 31 miles per hour less than 1 percent of the time. The strongest winds generally blow from the northwest, west, or southwest.

An average of between 60 and 70 percent of the pos-

[8] The growing season is the number of days between the last date on which a temperature of 32 degrees or lower is received in spring and the first date on which a temperature of 32 degrees or lower is received in fall.

TABLE 9.—*Probabilities of last freezing temperatures in spring and first in fall at River Falls, Wis., for 5 selected temperatures*

Probability	Dates for given probability and temperature				
	16° F. or lower	20° F. or lower	24° F. or lower	28° F. or lower	32° F. or lower
Spring:					
2 years in 10 later than	April 6	April 22	May 1	May 15	May 24
4 years in 10 later than	March 29	April 14	April 23	May 8	May 17
6 years in 10 later than	March 23	April 7	April 17	May 1	May 11
8 years in 10 later than	March 15	March 31	April 10	April 24	May 5
Fall:					
2 years in 10 earlier than	October 28	October 19	October 7	September 27	September 16
4 years in 10 earlier than	November 5	October 27	October 14	October 5	September 23
6 years in 10 earlier than	November 11	November 2	October 21	October 11	September 29
8 years in 10 earlier than	November 18	November 10	October 29	October 19	October 5

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sible amount of sunshine is received from June through September, and nearly 40 percent is received during November and December. During the rest of the year, the amount of possible sunshine received is between 50 and 60 percent.

The approximate variations in relative humidity for the seasons of the year are given in table 10. The relative humidity is generally higher in winter than in other seasons of the year.

TABLE 10.—*Approximate variations in relative humidity for the seasons of the year*

Relative humidity	Time in winter	Time in spring	Time in summer	Time in fall
	Percent	*Percent*	*Percent*	*Percent*
Less than 50 percent	5	20	20	15
50 to 79 percent	55	50	50	55
Greater than 79 percent	40	30	30	30

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Glossary

Acidity. See Reaction, soil.

AC soil. A soil that has only A and C horizons in the profile and no clearly developed B horizon.

Aggregate, soil. A single mass or cluster consisting of many individual soil particles held together, such as a prism, crumb, or granule.

Alluvium. Soil or rock material, such as gravel, sand, silt, or clay, that has been deposited on land by a stream.

Available moisture capacity. The amount of moisture usable by plants that can be stored in the root zone of a soil or to a depth of 60 inches, whichever is shallower. Following are terms for available moisture capacity used in this soil survey and their approximate quantitative value:

	Inches
Very high	More than 12
High	9 to 12
Moderate	6 to 12
Fair	3 to 6
Low	Less than 3

Blowout. An area from which most, or all, of the soil material has been removed by wind.

Bottom land. Nearly level land on the bottom of a valley that has a stream flowing through it. Subject to flooding and often referred to as a flood plain.

Chert. Irregularly shaped, angular fragments of crystalline quartz rock weathered from cherty limestone.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt. See also Texture, soil.

Concave slope. A slope that is shaped like a dish or bowl.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent; will not hold together in a mass.

Friable.—When moist, crushes easily under gentle to moderate pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes easily under gentle to moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a wire when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material; tends to stretch somewhat and pull apart, rather than pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Convex slope. A slope that is bowed out.

Diversion. A broad-bottomed ditch that serves to divert runoff so that the water will flow around the slope to a safe outlet.

Dolomite. A rock that contains a high proportion of calcium and magnesium carbonates. Ground dolomitic limestone that contains considerable magnesium carbonate, as well as calcium carbonate, is used widely as agricultural lime, especially on soils that have a low content of magnesium.

Drainage, natural. Refers to the condition that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of a drainage outlet. The following six different classes of drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable, and they have low available water capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and commonly have a texture intermediate between that of coarse-textured and fine-textured soils.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and in the C horizons.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or very sparse in some soils.

Very poorly drained soils are wet nearly all of the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Droughty soil. A soil that has low available moisture capacity.

Horizon, soil. A layer of soil, approximately parallel to the soil surface, that has distinct characteristics produced by soil-forming processes. Following are the relative positions of the several soil horizons in the profile and their nomenclature:

Horizon A.—The master horizon consisting of (1) one or more mineral horizons of maximum organic accumulation; (2) surface or subsurface horizons that are lighter in color than the underlying horizon and that have lost clay minerals, iron, and aluminum with resultant concentration of the more resistant minerals; or (3) horizons belonging to both of these categories.

Horizon B.—The master horizon of altered material characterized by (1) an accumulation of clay, iron, or aluminum, with accessory organic material; (2) blocky or prismatic structure together with other characteristics, such as stronger colors, unlike those of the A horizons or the underlying

horizons of nearly unchanged material; or (3) characteristics of both these categories. Commonly, the lower limit of the B horizon corresponds to the lower limit of the solum.

Horizon C.—A mineral layer, excluding bedrock, that is either like or unlike the material from which the solum is presumed to have formed, relatively little affected by pedogenic processes, and lacking properties of the A or B horizon but including materials modified by weathering outside the zone of major biological activity.

Horizon R.—Underlying consolidated bedrock, such as granite, sandstone, or limestone. If the bedrock is presumed to be like the parent rock from which the adjacent overlying layer was formed, the symbol R is used alone. If the bedrock is presumed to be unlike the overlying material, the R is preceded by a Roman numeral, which denotes lithologic discontinuity.

Loess. Geologic deposit of fairly uniform, fine material, mostly silt, presumably transported by wind.

Mapping unit. Areas of soil of the same kind, outlined on the soil map and identified by a symbol.

Massive. Large, uniform masses of cohesive soil material, in some places with ill-defined and irregular breakage, as in some of the fine-textured soils formed in alluvium; structureless. See also Structure, soil.

Mottled. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Following are descriptive terms: Abundance—*few, common,* or *many;* size—*fine, medium,* or *coarse;* and contrast—*faint, distinct,* or *prominent.*

Neutral soil. See Reaction, soil.

Outwash. Crossbedded gravel, sand, and silt deposited by melt water as it flowed from ice.

Ped. An individual natural soil aggregate, such as a crumb, prism, or block, in contrast to a clod.

Permeability, soil. The quality of a soil that enables it to transmit air and water. The following relative classes of soil permeability refer to estimated rates of movement of water in inches per hour through saturated, undisturbed cores under a one-half inch head of water:

	Inches per hour
Very slow	Less than 0.05
Slow	0.05 to 0.20
Moderately slow	0.20 to 0.80
Moderate	0.80 to 2.50
Moderately rapid	2.50 to 5.00
Rapid	5.00 to 10.00
Very rapid	10.00 or more

Profile. A vertical section of a soil through all its horizons and extending into the parent material. See also Horizon, soil.

Reaction, soil. The degree of acidity or alkalinity of the soil expressed in pH value or in words as follows:

	pH		*pH*
Extremely acid	Below 4.5	Mildly alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.0	Moderately alkaline	7.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and higher
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

Relief. The elevations or inequalities of the land surface, considered collectively.

Renovation. Method of restoring soils used for pasture or hay to higher productivity by cultivating them carefully so that the tillage will not cause erosion. The soils are then limed, fertilized, and reseeded.

Sand. Individual rock or mineral fragments having diameters ranging from 0.05 millimeter (0.002 inch) to 2.0 millimeters (0.079 inch). Sand grains consist chiefly of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay. See also Texture, soil.

Silt. Individual mineral particles in a soil that range in diameter between the upper limit of clay (0.002 millimeter) and the lower limit of very fine sand (0.05 millimeter). Soil of the textural class called silt contains 80 percent or more of silt and less than 12 percent of clay. See also Texture, soil.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in a mature soil includes the A and B horizons. Generally, the characteristics of the minerals in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Stratified. Composed of, or arranged in, strata, or layers, such as stratified alluvium. The term is confined to geological materials. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are *platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms have rounded tops), *blocky* (angular or subangular), and *granular.* Structure is also described by grade (*weak, moderate,* or *strong*), that is, the distinctness and durability of the aggregates, and by size (*very fine, fine, medium, coarse,* or *very coarse*). *Structureless* soils are (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon of soils that have a distinct profile. Roughly, that part of the profile below plow depth. See also Horizon, soil.

Substratum. Any layer beneath the solum, either conforming (C or R) or unconforming. See also Horizon, soil.

Surface soil. Technically, the A horizon; commonly, the upper part of the profile ordinarily moved in tillage, or its equivalent in uncultivated soils.

Terrace, stream. An old alluvial plain, ordinarily nearly level or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. They are generally underlain by stratified stream sediments.

Terracing. Construction of shallow, nearly level ditches that have broad slopes suitable for farming. Terraces are used for controlling runoff on slopes.

Texture, soil. The relative proportions of particles of sand, silt, and clay in a soil. The basic textural classes in increasing proportions of fine particles are sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Topsoil. Presumably fertile soil material, ordinarily rich in organic matter, used to topdress roadbanks, the shoulders of roads, slopes, lawns, and gardens.

Upland. Land that lies above the stream terraces and that is underlain by bedrock at a fairly shallow depth; generally, all areas not included in terraces or bottom lands.

Variant. A soil that has many characteristics of the series in which it is placed but that differs in at least one important characteristic, indicated by its name. The acreage of a variant is of too small extent to justify establishing a new series. A new series may be designated and replace the variant, however, if sufficient acreage is later found.

Vesicular. Having small openings or pores, as pores within the structural aggregates of a soil.

GUIDE TO MAPPING UNITS

[For a full description of a mapping unit, read both the description of the mapping unit and the description of the soil series to which the mapping unit belongs.

[See table 1, page 26, for the predicted average acre yields of the principal field crops and pasture; table 2, page 38, for estimated potential annual yields per acre of wood products; and table 6, page 80, for approximate acreage and proportionate extent of the soils mapped. For facts about engineering uses of the soils, see the section "Engineering Uses of the Soils" beginning on page 37]

Map symbol	Mapping unit	Described on page	Capability unit Symbol	Capability unit Page	Woodland suitability group Number	Woodland suitability group Page
Ad	Adrian muck	82	IVw-7	22	10	36
Ae	Alluvial land, loamy, nearly level	83	IIIw-12	19	1	33
Ag	Alluvial land, loamy, gently sloping	83	IIIw-12	19	1	33
Ah	Alluvial land, sandy	83	VIIs-9	25	4	34
Al	Alluvial land, wet	83	Vw-14	22	9	36
AmA	Almena silt loam, 0 to 2 percent slopes	84	IIw-4	15	7	35
AmB	Almena silt loam, 2 to 6 percent slopes	84	IIw-4	15	7	35
AmB2	Almena silt loam, 2 to 6 percent slopes, moderately eroded	84	IIw-4	15	7	35
AnA	Antigo silt loam, 0 to 2 percent slopes	84	IIs-1	14	1	33
AnB	Antigo silt loam, 2 to 6 percent slopes	85	IIe-2	14	1	33
AnB2	Antigo silt loam, 2 to 6 percent slopes, moderately eroded	85	IIe-2	14	1	33
Ar	Arenzville silt loam	85	IIw-11	16	1	33
AsB	Arland loam, 2 to 6 percent slopes	85	IIe-2	14	1	33
AsC2	Arland loam, 6 to 12 percent slopes, moderately eroded	85	IIIe-2	17	1	33
Au	Auburndale silt loam	86	IIIw-3	19	7	35
BfE2	Boone fine sand, 12 to 35 percent slopes, eroded	86	VIIs-9	25	4	34
BnB2	Boone loamy fine sand, 2 to 6 percent slopes, eroded	86	IVs-3	21	4	34
BnC2	Boone loamy fine sand, 6 to 12 percent slopes, eroded	86	VIs-3	24	4	34
BrA	Burkhardt loam, 0 to 2 percent slopes	87	IIIs-2	18	12	36
BuA	Burkhardt sandy loam, 0 to 2 percent slopes	87	IIIs-2	18	5	35
BuB	Burkhardt sandy loam, 2 to 6 percent slopes	87	IIIe-4	17	5	35
CaA	Chaseburg silt loam, 0 to 2 percent slopes	87	I-1	13	1	33
CaB	Chaseburg silt loam, 2 to 6 percent slopes	88	IIe-5	14	1	33
ChB	Chetek sandy loam, 2 to 6 percent slopes	88	IIIe-4	17	5	35
ChD2	Chetek sandy loam, 12 to 20 percent slopes, moderately eroded	88	VIe-4	23	5	35
Cl	Clyde silt loam	88	IIw-1	14	12	36
DaA	Dakota loam, 0 to 2 percent slopes	89	IIs-1	14	12	36
DaB	Dakota loam, 2 to 6 percent slopes	89	IIe-2	14	12	36
DaC2	Dakota loam, 6 to 12 percent slopes, moderately eroded	89	IIIe-2	17	12	36
DbA	Dakota loam, loamy substratum, 0 to 2 percent slopes	89	I-1	13	12	36
DbB	Dakota loam, loamy substratum, 2 to 6 percent slopes	89	IIe-1	13	12	36
DcA	Dakota loam, rock substratum, 0 to 2 percent slopes	90	IIs-1	14	12	36
DcB2	Dakota loam, rock substratum, 2 to 6 percent slopes, eroded	90	IIe-2	14	12	36
DdA	Dakota sandy loam, 0 to 2 percent slopes	90	IIIs-2	18	3	34
DdB	Dakota sandy loam, 2 to 6 percent slopes	90	IIIe-4	17	3	34
DeA	Derinda silt loam, 0 to 2 percent slopes	90	IIIs-8	19	1	33
DeB	Derinda silt loam, 2 to 6 percent slopes	90	IIIe-3	17	1	33
DeB2	Derinda silt loam, 2 to 6 percent slopes, moderately eroded	91	IIIe-3	17	1	33
DeC	Derinda silt loam, 6 to 12 percent slopes	91	IVe-3	20	1	33
DeC2	Derinda silt loam, 6 to 12 percent slopes, moderately eroded	91	IVe-3	20	1	33
DeD	Derinda silt loam, 12 to 20 percent slopes	91	VIe-3	23	1	33
DeD2	Derinda silt loam, 12 to 20 percent slopes, moderately eroded	91	VIe-3	23	1	33
DeE	Derinda silt loam, 20 to 30 percent slopes	91	VIIe-3	24	1	33

Map symbol	Mapping unit	Described on page	Capability unit Symbol	Capability unit Page	Woodland suitability group Number	Woodland suitability group Page
DfC2	Derinda silt loam, acid variant, 6 to 12 percent slopes, moderately eroded	92	IVe-3	20	5	35
DfD2	Derinda silt loam, acid variant, 12 to 20 percent slopes, eroded	92	VIe-3	23	5	35
DkB2	Dickinson fine sandy loam, 2 to 6 percent slopes, moderately eroded	92	IIe-7	14	3	34
DoB	Downs silt loam, 2 to 6 percent slopes	92	IIe-1	13	1	33
DoB2	Downs silt loam, 2 to 6 percent slopes, moderately eroded	92	IIe-1	13	1	33
DoC2	Downs silt loam, 6 to 12 percent slopes, moderately eroded	93	IIIe-1	17	1	33
DsA	Dubuque silt loam, 0 to 2 percent slopes	93	I-1	13	1	33
DsB	Dubuque silt loam, 2 to 6 percent slopes	93	IIe-1	13	1	33
DsB2	Dubuque silt loam, 2 to 6 percent slopes, moderately eroded	93	IIe-1	13	1	33
DsC	Dubuque silt loam, 6 to 12 percent slopes	93	IIIe-1	17	1	33
DsC2	Dubuque silt loam, 6 to 12 percent slopes, moderately eroded	93	IIIe-1	17	1	33
DsD	Dubuque silt loam, 12 to 20 percent slopes	94	IVe-1	20	1	33
DsD2	Dubuque silt loam, 12 to 20 percent slopes, moderately eroded	94	IVe-1	20	1	33
DsE	Dubuque silt loam, 20 to 30 percent slopes	94	VIe-1	22	1	33
DsE2	Dubuque silt loam, 20 to 30 percent slopes, moderately eroded	94	VIe-1	22	1	33
DsF	Dubuque silt loam, 30 to 40 percent slopes	94	VIIe-1	24	1	33
DtB3	Dubuque soils, 2 to 6 percent slopes, severely eroded	94	IIIe-1	17	1	33
DtC3	Dubuque soils, 6 to 12 percent slopes, severely eroded	94	IVe-1	20	1	33
DtD3	Dubuque soils, 12 to 20 percent slopes, severely eroded	94	VIe-1	22	1	33
DuB	Dunbarton silt loam, 2 to 6 percent slopes	95	IIIe-3	17	5	35
DuB2	Dunbarton silt loam, 2 to 6 percent slopes, moderately eroded	95	IIIe-3	17	5	35
DuC	Dunbarton silt loam, 6 to 12 percent slopes	95	IVe-3	20	5	35
DuC2	Dunbarton silt loam, 6 to 12 percent slopes, moderately eroded	95	IVe-3	20	5	35
DuD	Dunbarton silt loam, 12 to 20 percent slopes	95	VIe-3	23	5	35
DuD2	Dunbarton silt loam, 12 to 20 percent slopes, moderately eroded	96	VIe-3	23	5	35
DuE	Dunbarton silt loam, 20 to 30 percent slopes	96	VIIe-3	24	5	35
DuE2	Dunbarton silt loam, 20 to 30 percent slopes, moderately eroded	96	VIIe-3	24	5	35
DvC	Dunbarton complex, 6 to 12 percent slopes	96	IVe-3	20	5	35
DvC2	Dunbarton complex, 6 to 12 percent slopes, moderately eroded	96	IVe-3	20	5	35
DvD	Dunbarton complex, 12 to 20 percent slopes	96	VIe-3	23	5	35
DvD2	Dunbarton complex, 12 to 20 percent slopes, moderately eroded	96	VIe-3	23	5	35
DvE	Dunbarton complex, 20 to 30 percent slopes	97	VIIe-3	24	5	35
DvE2	Dunbarton complex, 20 to 30 percent slopes, moderately eroded	97	VIIe-3	24	5	35
EdC2	Edith soils, 6 to 12 percent slopes, eroded	98	VIs-5	24	12	36
EdD	Edith soils, 12 to 20 percent slopes	98	VIs-5	24	12	36
EdD2	Edith soils, 12 to 20 percent slopes, moderately eroded	98	VIs-5	24	12	36
EdE	Edith soils, 20 to 30 percent slopes	98	VIIs-5	24	12	36
EwC2	Edith-Wykoff soils, 6 to 12 percent slopes, eroded	98	IVe-3	20	5	35
EwD2	Edith-Wykoff soils, 12 to 20 percent slopes, eroded	98	VIs-5	24	5	35
EwD3	Edith-Wykoff soils, 12 to 20 percent slopes, severely eroded	99	VIIs-5	24	5	35
EwE	Edith-Wykoff soils, 20 to 30 percent slopes	99	VIIs-5	24	5	35

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit Symbol	Capability unit Page	Woodland suitability group Number	Woodland suitability group Page
FaA	Fayette silt loam, benches, 0 to 2 percent slopes-----	99	I-1	13	1	33
FaB	Fayette silt loam, benches, 2 to 6 percent slopes-----	99	IIe-1	13	1	33
FaC2	Fayette silt loam, benches, 6 to 12 percent slopes, moderately eroded--	99	IIIe-1	17	1	33
FlB	Floyd silt loam, 2 to 6 percent slopes----------------	100	IIw-1	14	12	36
FnB2	Freeon silt loam, 2 to 6 percent slopes, moderately eroded--	100	IIe-1	13	1	33
FnC2	Freeon silt loam, 6 to 12 percent slopes, moderately eroded--	100	IIIe-1	17	1	33
Fr	Freer silt loam---------------------------------------	101	IIw-4	15	7	35
GaB	Gale silt loam, 2 to 6 percent slopes-----------------	101	IIe-2	14	1	33
GaB2	Gale silt loam, 2 to 6 percent slopes, moderately eroded--	101	IIe-2	14	1	33
GaC2	Gale silt loam, 6 to 12 percent slopes, eroded--------	101	IIIe-2	17	1	33
GaD2	Gale silt loam, 12 to 20 percent slopes, moderately eroded--	101	IVe-2	20	1	33
GtC2	Gale silt loam, thin solum variant, 6 to 12 percent slopes, eroded------------------------------------	102	IVe-3	20	5	35
GtD	Gale silt loam, thin solum variant, 12 to 20 percent slopes---	102	VIe-3	23	5	35
GtD2	Gale silt loam, thin solum variant, 12 to 20 percent slopes, moderately eroded--------------------------	102	VIe-3	23	5	35
GtE	Gale silt loam, thin solum variant, 20 to 30 percent slopes---	102	VIIe-3	24	5	35
HaA	Halder loam, 0 to 2 percent slopes--------------------	102	IIw-5	16	7	35
HdA	Halder loam, sandy substratum, 0 to 3 percent slopes--	102	IIw-5	16	7	35
HeB2	Hesch fine sandy loam, loamy substratum, 2 to 6 percent slopes, moderately eroded---------------------	103	IIe-7	14	3	34
HeC2	Hesch fine sandy loam, loamy substratum, 6 to 12 percent slopes, moderately eroded---------------------	103	IIIe-7	18	3	34
HeD2	Hesch fine sandy loam, loamy substratum, 12 to 20 percent slopes, eroded-------------------------------	103	IVe-7	21	3	34
HlB	Hesch loam, loamy substratum, 2 to 6 percent slopes---	103	IIe-1	13	12	36
HlB2	Hesch loam, loamy substratum, 2 to 6 percent slopes, moderately eroded--------------------------------	103	IIe-1	13	12	36
HlC2	Hesch loam, loamy substratum, 6 to 12 percent slopes, moderately eroded--------------------------------	104	IIIe-1	17	12	36
HlD2	Hesch loam, loamy substratum, 12 to 20 percent slopes, moderately eroded--------------------------------	104	IVe-1	20	12	36
HmC2	Hixton fine sandy loam, 6 to 12 percent slopes, moderately eroded--------------------------------	104	IVe-4	20	3	34
HmD2	Hixton fine sandy loam, 12 to 20 percent slopes, moderately eroded--------------------------------	104	VIe-4	23	3	34
HnB	Hixton fine sandy loam, loamy substratum, 2 to 6 percent slopes-------------------------------------	104	IIe-7	14	3	34
HnB2	Hixton fine sandy loam, loamy substratum, 2 to 6 percent slopes, moderately eroded------------------	105	IIe-7	14	3	34
HnC	Hixton fine sandy loam, loamy substratum, 6 to 12 percent slopes-------------------------------------	105	IIIe-7	18	3	34
HnC2	Hixton fine sandy loam, loamy substratum, 6 to 12 percent slopes, moderately eroded------------------	105	IIIe-7	18	3	34
HnD	Hixton fine sandy loam, loamy substratum, 12 to 20 percent slopes-------------------------------------	105	IVe-7	21	3	34
HnD2	Hixton fine sandy loam, loamy substratum, 12 to 20 percent slopes, moderately eroded------------------	105	IVe-7	21	3	34
HnE	Hixton fine sandy loam, loamy substratum, 20 to 30 percent slopes-------------------------------------	105	VIe-7	23	3	34
HtB	Hixton loam, loamy substratum, 2 to 6 percent slopes--	105	IIe-1	13	1	33
HtC2	Hixton loam, loamy substratum, 6 to 12 percent slopes, moderately eroded--------------------------------	106	IIIe-1	17	1	33

Map symbol	Mapping unit	Described on page	Capability unit		Woodland suitability group	
			Symbol	Page	Number	Page
HtD2	Hixton loam, loamy substratum, 12 to 20 percent slopes, eroded	106	IVe-1	20	1	33
LaB2	Lamont very fine sandy loam, 2 to 6 percent slopes, moderately eroded	106	IIe-7	14	3	34
LaC2	Lamont very fine sandy loam, 6 to 12 percent slopes, moderately eroded	106	IIIe-7	18	3	34
LaD2	Lamont very fine sandy loam, 12 to 20 percent slopes, moderately eroded	106	IVe-7	21	3	34
LcA	Lawler loam, 0 to 3 percent slopes	107	IIw-5	16	12	36
LwA	Lawler silt loam, 0 to 2 percent slopes	107	IIw-5	16	12	36
LwB	Lawler silt loam, 2 to 6 percent slopes	107	IIw-5	16	12	36
MdA	Meridian loam, 0 to 2 percent slopes	107	IIs-1	14	1	33
MdB	Meridian loam, 2 to 6 percent slopes	107	IIe-2	14	1	33
OmA	Onamia loam, 0 to 2 percent slopes	108	IIs-1	14	1	33
OmB	Onamia loam, 2 to 6 percent slopes	108	IIe-2	14	1	33
OmB2	Onamia loam, 2 to 6 percent slopes, moderately eroded	108	IIe-2	14	1	33
OmC2	Onamia loam, 6 to 12 percent slopes, moderately eroded	108	IIIe-2	17	1	33
OmD2	Onamia loam, 12 to 20 percent slopes, moderately eroded	108	IVe-2	20	1	33
OnB	Onamia sandy loam, 2 to 6 percent slopes	108	IIIe-4	17	3	34
OnC2	Onamia sandy loam, 6 to 12 percent slopes, moderately eroded	109	IVe-4	20	3	34
Or	Orion silt loam	109	IIw-13	16	9	36
OsA	Ostrander silt loam, 0 to 2 percent slopes	109	I-1	13	12	36
OsB	Ostrander silt loam, 2 to 6 percent slopes	110	IIe-1	13	12	36
OsB2	Ostrander silt loam, 2 to 6 percent slopes, moderately eroded	110	IIe-1	13	12	36
OsC2	Ostrander silt loam, 6 to 12 percent slopes, moderately eroded	110	IIIe-1	17	12	36
OtB	Otterholt silt loam, 2 to 6 percent slopes	110	IIe-1	13	1	33
OtB2	Otterholt silt loam, 2 to 6 percent slopes, moderately eroded	110	IIe-1	13	1	33
OtC	Otterholt silt loam, 6 to 12 percent slopes	110	IIIe-1	17	1	33
OtC2	Otterholt silt loam, 6 to 12 percent slopes, moderately eroded	110	IIIe-1	17	1	33
OtC3	Otterholt silt loam, 6 to 12 percent slopes, severely eroded	111	IVe-1	20	1	33
OtD2	Otterholt silt loam, 12 to 20 percent slopes, moderately eroded	111	IVe-1	20	1	33
PmA	Plainfield loamy sand, 0 to 2 percent slopes	111	IVs-3	21	4	34
PmB	Plainfield loamy sand, 2 to 6 percent slopes	111	IVs-3	21	4	34
PmB2	Plainfield loamy sand, 2 to 6 percent slopes, eroded	111	IVs-3	21	4	34
PmC	Plainfield loamy sand, 6 to 12 percent slopes	111	VIs-3	24	4	34
PmC2	Plainfield loamy sand, 6 to 12 percent slopes, eroded	112	VIs-3	24	4	34
PoA	Port Byron silt loam, 0 to 2 percent slopes	112	I-1	13	12	36
PoB	Port Byron silt loam, 2 to 6 percent slopes	112	IIe-1	13	12	36
PoC2	Port Byron silt loam, 6 to 12 percent slopes, moderately eroded	112	IIIe-1	17	12	36
RaB	Racine silt loam, 2 to 6 percent slopes	112	IIe-1	13	1	33
RaB2	Racine silt loam, 2 to 6 percent slopes, moderately eroded	112	IIe-1	13	1	33
RaC2	Racine silt loam, 6 to 12 percent slopes, moderately eroded	113	IIIe-1	17	1	33
ReA	Renova silt loam, 0 to 2 percent slopes	113	I-1	13	1	33
ReB	Renova silt loam, 2 to 6 percent slopes	113	IIe-1	13	1	33
ReB2	Renova silt loam, 2 to 6 percent slopes, moderately eroded	113	IIe-1	13	1	33
ReC	Renova silt loam, 6 to 12 percent slopes	113	IIIe-1	17	1	33

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit Symbol	Capability unit Page	Woodland suitability group Number	Woodland suitability group Page
ReC2	Renova silt loam, 6 to 12 percent slopes, moderately eroded	113	IIIe-1	17	1	33
ReC3	Renova silt loam, 6 to 12 percent slopes, severely eroded	114	IVe-1	20	1	33
ReD	Renova silt loam, 12 to 20 percent slopes	114	IVe-1	20	1	33
ReD2	Renova silt loam, 12 to 20 percent slopes, moderately eroded	114	IVe-1	20	1	33
ReD3	Renova silt loam, 12 to 20 percent slopes, severely eroded	114	VIe-1	22	1	33
RfB2	Renova fine sandy loam, sandy variant, 2 to 6 percent slopes, eroded	114	IIe-7	14	3	34
RfC2	Renova fine sandy loam, sandy variant, 6 to 12 percent slopes, eroded	115	IIIe-7	18	3	34
RfD2	Renova fine sandy loam, sandy variant, 12 to 20 percent slopes, eroded	115	IVe-7	21	3	34
Rh	Riverwash	115	VIIIs-10	25	11	36
RoB	Rockton complex, 2 to 6 percent slopes	115	IIe-2	14	12	36
RoC2	Rockton complex, 6 to 12 percent slopes, moderately eroded	115	IVe-3	20	12	36
RtA	Rozetta silt loam, benches, 0 to 2 percent slopes	116	I-1	13	1	33
RtB	Rozetta silt loam, benches, 2 to 6 percent slopes	116	IIe-1	13	1	33
Sa	Sable silt loam	116	IIw-1	14	12	36
SbB	Santiago silt loam, 2 to 6 percent slopes	116	IIe-1	13	1	33
SbB2	Santiago silt loam, 2 to 6 percent slopes, moderately eroded	116	IIe-1	13	1	33
SbC2	Santiago silt loam, 6 to 12 percent slopes, moderately eroded	117	IIIe-1	17	1	33
SgA	Sargeant silt loam, 0 to 2 percent slopes	117	IIw-2	15	7	35
SgB	Sargeant silt loam, 2 to 6 percent slopes	117	IIw-2	15	7	35
SgB2	Sargeant silt loam, 2 to 6 percent slopes, moderately eroded	117	IIw-2	15	7	35
SgC	Sargeant silt loam, 6 to 12 percent slopes	117	IIIe-8	18	7	35
SgC2	Sargeant silt loam, 6 to 12 percent slopes, moderately eroded	118	IIIe-8	18	7	35
ShC	Schapville silt loam, 6 to 12 percent slopes	118	IVe-3	20	12	36
ShC2	Schapville silt loam, 6 to 12 percent slopes, moderately eroded	118	IVe-3	20	12	36
ShD2	Schapville silt loam, 12 to 20 percent slopes, moderately eroded	118	VIe-3	23	12	36
ShE2	Schapville silt loam, 20 to 30 percent slopes, eroded	118	VIIe-3	24	12	36
SkB2	Schapville silt loam, wet subsoil variant, 2 to 6 percent slopes, eroded	119	IIw-3	15	12	36
SnB	Seaton silt loam, 2 to 6 percent slopes	119	IIe-1	13	1	33
SnB2	Seaton silt loam, 2 to 6 percent slopes, moderately eroded	119	IIe-1	13	1	33
SnC	Seaton silt loam, 6 to 12 percent slopes	119	IIIe-1	17	1	33
SnC2	Seaton silt loam, 6 to 12 percent slopes, moderately eroded	119	IIIe-1	17	1	33
SnC3	Seaton silt loam, 6 to 12 percent slopes, severely eroded	120	IIIe-1	17	1	33
SnD	Seaton silt loam, 12 to 20 percent slopes	120	IVe-1	20	1	33
SnD2	Seaton silt loam, 12 to 20 percent slopes, moderately eroded	120	IVe-1	20	1	33
SnD3	Seaton silt loam, 12 to 20 percent slopes, severely eroded	120	IVe-1	20	1	33
SnE	Seaton silt loam, 20 to 30 percent slopes	120	VIe-1	22	1	33
SnE2	Seaton silt loam, 20 to 30 percent slopes, moderately eroded	120	VIe-1	22	1	33
SoA	Sogn-Rockton loams, 0 to 2 percent slopes	121	IVs-3	21	12	36
SoB	Sogn-Rockton loams, 2 to 6 percent slopes	121	IVs-3	21	12	36

Map symbol	Mapping unit	Described on page	Capability unit Symbol	Capability unit Page	Woodland suitability group Number	Woodland suitability group Page
SoC2	Sogn-Rockton loams, 6 to 12 percent slopes, moderately eroded	121	VIe-3	23	12	36
SoD2	Sogn-Rockton loams, 12 to 20 percent slopes, moderately eroded	121	VIIe-3	24	12	36
SpA	Sparta loamy sand, 0 to 2 percent slopes	121	IVs-3	21	4	34
SpB	Sparta loamy sand, 2 to 6 percent slopes	121	IVs-3	21	4	34
SpB2	Sparta loamy sand, 2 to 6 percent slopes, eroded	121	IVs-3	21	4	34
SpC2	Sparta loamy sand, 6 to 12 percent slopes, eroded	121	VIs-3	24	4	34
SrA	Spencer silt loam, 0 to 2 percent slopes	122	I-1	13	1	33
SrB	Spencer silt loam, 2 to 6 percent slopes	122	IIe-1	13	1	33
SrB2	Spencer silt loam, 2 to 6 percent slopes, moderately eroded	122	IIe-1	13	1	33
SrC2	Spencer silt loam, 6 to 12 percent slopes, moderately eroded	122	IIIe-1	17	1	33
StF	Steep stony and rocky land	122	VIIs-9	25	5	35
SuA	Stronghurst silt loam, benches, 0 to 2 percent slopes	123	IIw-2	15	7	35
TeA	Tell silt loam, 0 to 2 percent slopes	123	IIs-1	14	1	33
TeB2	Tell silt loam, 2 to 6 percent slopes, eroded	123	IIe-2	14	1	33
Tl	Terrace escarpments, loamy	124	VIIe-1	24	1	33
Ts	Terrace escarpments, sandy	124	VIIs-9	25	4	34
Tx	Terril loam	124	IIw-11	16	12	36
VaB	Vlasaty silt loam, 2 to 6 percent slopes	125	IIe-1	13	1	33
VaB2	Vlasaty silt loam, 2 to 6 percent slopes, moderately eroded	125	IIe-1	13	1	33
VaC	Vlasaty silt loam, 6 to 12 percent slopes	125	IIIe-1	17	1	33
VaC2	Vlasaty silt loam, 6 to 12 percent slopes, moderately eroded	125	IIIe-1	17	1	33
WaA	Waukegan silt loam, 0 to 2 percent slopes	125	IIs-1	14	12	36
WaB	Waukegan silt loam, 2 to 6 percent slopes	125	IIe-2	14	12	36
WhA	Whalan silt loam, 0 to 2 percent slopes	126	IIs-1	14	1	33
WhB	Whalan silt loam, 2 to 6 percent slopes	126	IIe-2	14	1	33
WhB2	Whalan silt loam, 2 to 6 percent slopes, moderately eroded	126	IIe-2	14	1	33
WhC	Whalan silt loam, 6 to 12 percent slopes	126	IIIe-2	17	1	33
WhC2	Whalan silt loam, 6 to 12 percent slopes, moderately eroded	126	IIIe-2	17	1	33
WhD	Whalan silt loam, 12 to 20 percent slopes	126	IVe-2	20	1	33
WhD2	Whalan silt loam, 12 to 20 percent slopes, moderately eroded	127	IVe-2	20	1	33
WhD3	Whalan silt loam, 12 to 20 percent slopes, severely eroded	127	VIe-2	22	1	33
WhE	Whalan silt loam, 20 to 30 percent slopes	127	VIe-2	22	1	33
WhE2	Whalan silt loam, 20 to 30 percent slopes, moderately eroded	127	VIe-2	22	1	33
Wn	Worthen silt loam	127	I-1	13	12	36
WoB	Wykoff loam, 2 to 6 percent slopes	128	IIe-2	14	5	35
WoB2	Wykoff loam, 2 to 6 percent slopes, moderately eroded	128	IIe-2	14	5	35
WoC	Wykoff loam, 6 to 12 percent slopes	128	IIIe-2	17	5	35
WoC2	Wykoff loam, 6 to 12 percent slopes, moderately eroded	128	IIIe-2	17	5	35
WoC3	Wykoff loam, 6 to 12 percent slopes, severely eroded	128	IVe-2	20	5	35
WoD	Wykoff loam, 12 to 20 percent slopes	128	IVe-2	20	5	35
WoD2	Wykoff loam, 12 to 20 percent slopes, moderately eroded	128	IVe-2	20	5	35
WoD3	Wykoff loam, 12 to 20 percent slopes, severely eroded	129	VIe-2	22	5	35
WsB	Wykoff silt loam, 2 to 6 percent slopes	129	IIe-2	14	5	35
WsB2	Wykoff silt loam, 2 to 6 percent slopes, moderately eroded	129	IIe-2	14	5	35
WsC2	Wykoff silt loam, 6 to 12 percent slopes, eroded	129	IIIe-2	17	5	35

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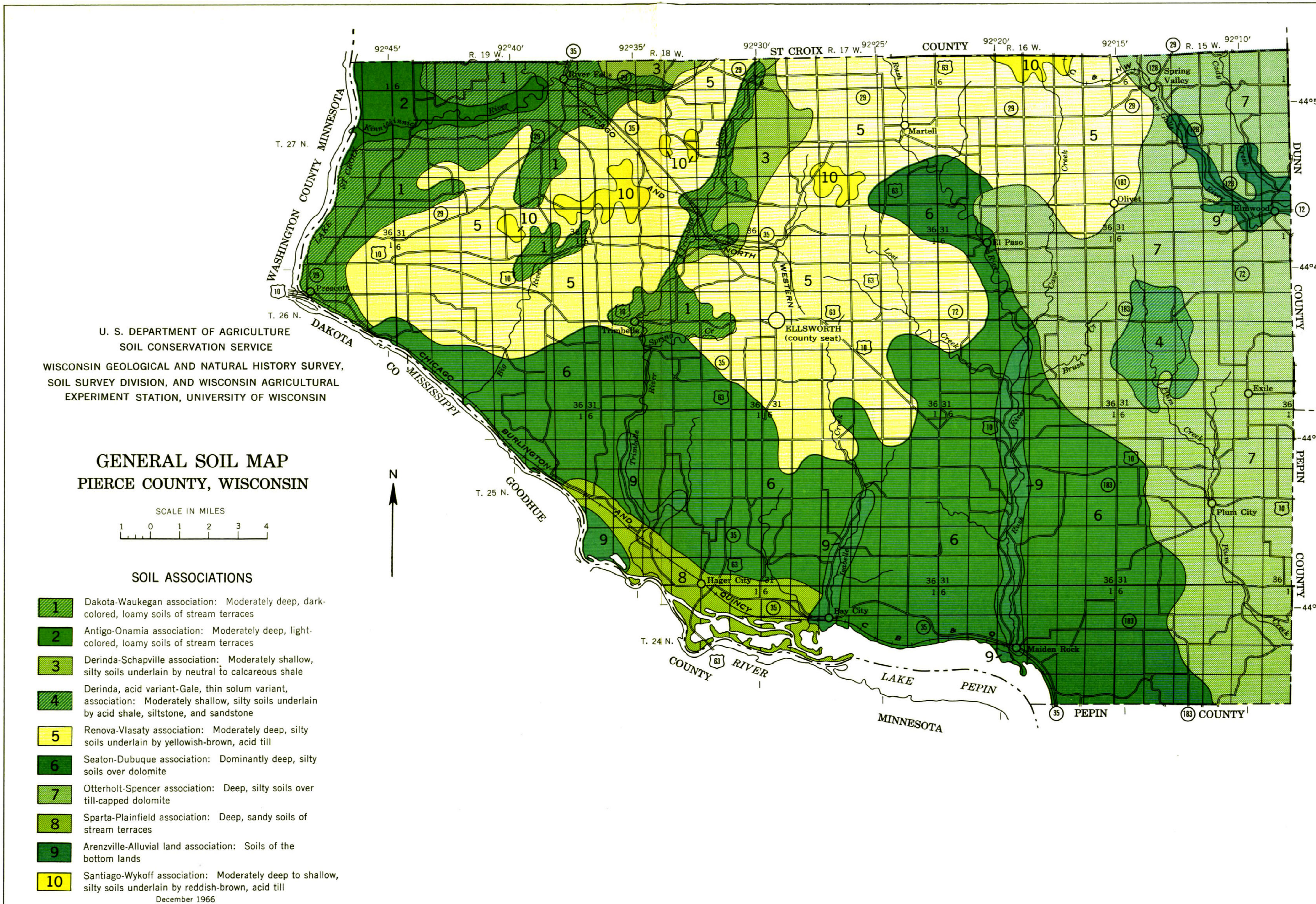


GENERAL SOIL MAP
PIERCE COUNTY, WISCONSIN

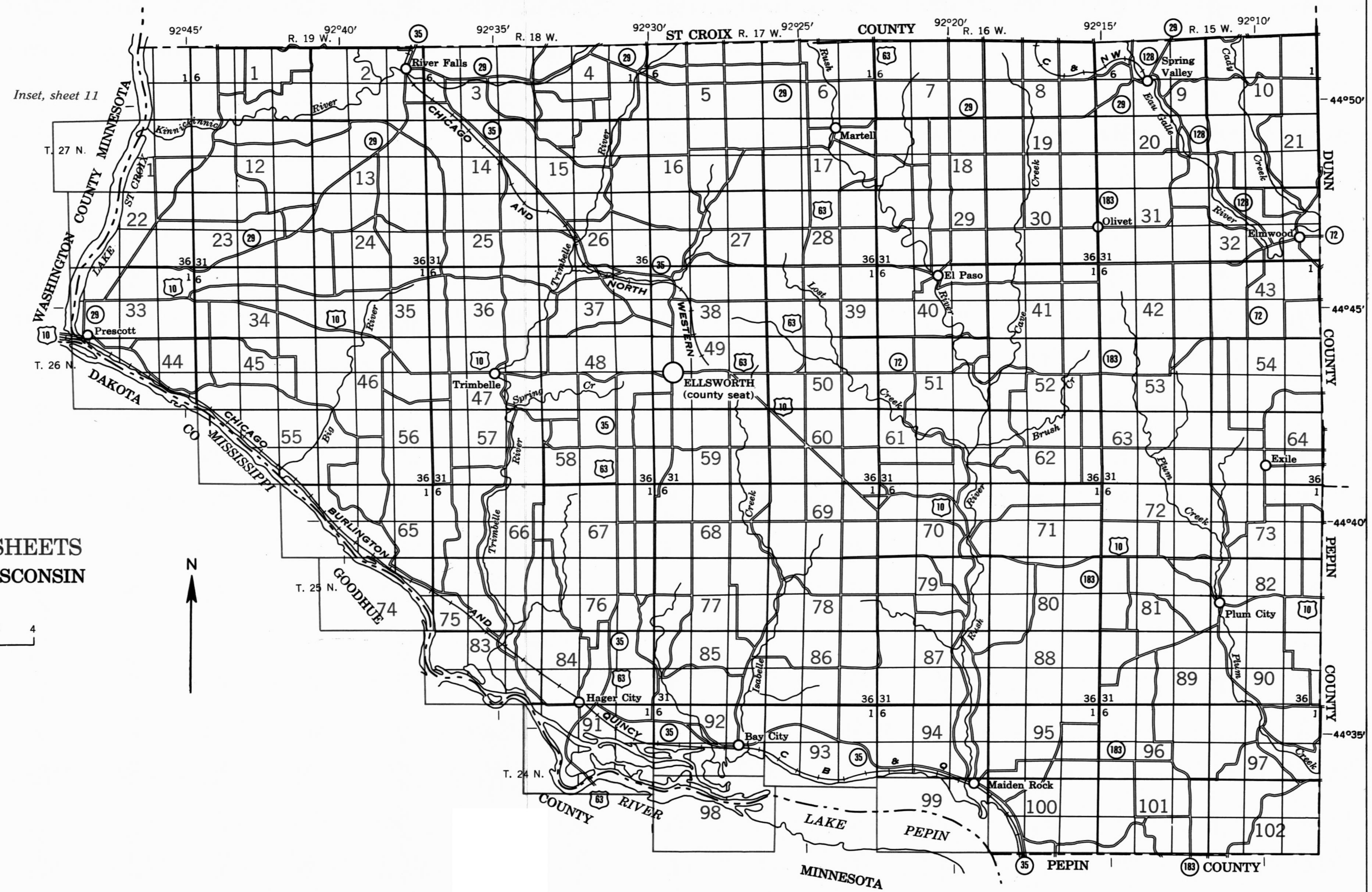
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY,
SOIL SURVEY DIVISION, AND WISCONSIN AGRICULTURAL
EXPERIMENT STATION, UNIVERSITY OF WISCONSIN

SOIL ASSOCIATIONS

1. Dakota-Waukegan association: Moderately deep, dark-colored, loamy soils of stream terraces
2. Antigo-Onamia association: Moderately deep, light-colored, loamy soils of stream terraces
3. Derinda-Schapville association: Moderately shallow, silty soils underlain by neutral to calcareous shale
4. Derinda, acid variant-Gale, thin solum variant, association: Moderately shallow, silty soils underlain by acid shale, siltstone, and sandstone
5. Renova-Vlasaty association: Moderately deep, silty soils underlain by yellowish-brown, acid till
6. Seaton-Dubuque association: Dominantly deep, silty soils over dolomite
7. Otterholt-Spencer association: Deep, silty soils over till-capped dolomite
8. Sparta-Plainfield association: Deep, sandy soils of stream terraces
9. Arenzville-Alluvial land association: Soils of the bottom lands
10. Santiago-Wykoff association: Moderately deep to shallow, silty soils underlain by reddish-brown, acid till

December 1966



INDEX TO MAP SHEETS
PIERCE COUNTY, WISCONSIN

SCALE IN MILES

1 0 1 2 3 4

SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, E, or F, shows the slope. Some symbols without a slope letter are for nearly level soils or land types, but some are for soils or land types that have a considerable range in slope. The number, 2 or 3, in a symbol indicates that the soil is eroded or severely eroded.

SYMBOL	NAME
Ad	Adrian muck
Ae	Alluvial land, loamy, nearly level
Ag	Alluvial land, loamy, gently sloping
Ah	Alluvial land, sandy
Al	Alluvial land, wet
AmA	Almena silt loam, 0 to 2 percent slopes
AmB	Almena silt loam, 2 to 6 percent slopes
AmB2	Almena silt loam, 2 to 6 percent slopes, moderately eroded
AnA	Antigo silt loam, 0 to 2 percent slopes
AnB	Antigo silt loam, 2 to 6 percent slopes
AnB2	Antigo silt loam, 2 to 6 percent slopes, moderately eroded
Ar	Arenzville silt loam
AsB	Arland loam, 2 to 6 percent slopes
AsC2	Arland loam, 6 to 12 percent slopes, moderately eroded
Au	Auburndale silt loam
BfE2	Boone fine sand, 12 to 35 percent slopes, eroded
BnB2	Boone loamy fine sand, 2 to 6 percent slopes, eroded
BnC2	Boone loamy fine sand, 6 to 12 percent slopes, eroded
BrA	Burkhardt loam, 0 to 2 percent slopes
BuA	Burkhardt sandy loam, 0 to 2 percent slopes
BuB	Burkhardt sandy loam, 2 to 6 percent slopes
CaA	Chaseburg silt loam, 0 to 2 percent slopes
CaB	Chaseburg silt loam, 2 to 6 percent slopes
ChB	Chetek sandy loam, 2 to 6 percent slopes
ChD2	Chetek sandy loam, 12 to 20 percent slopes, moderately eroded
Cl	Clyde silt loam
DaA	Dakota loam, 0 to 2 percent slopes
DaB	Dakota loam, 2 to 6 percent slopes
DaC2	Dakota loam, 6 to 12 percent slopes, moderately eroded
DbA	Dakota loam, loamy substratum, 0 to 2 percent slopes
DbB	Dakota loam, loamy substratum, 2 to 6 percent slopes
DcA	Dakota loam, rock substratum, 0 to 2 percent slopes
DcB2	Dakota loam, rock substratum, 2 to 6 percent slopes, eroded
DdA	Dakota sandy loam, 0 to 2 percent slopes
DdB	Dakota sandy loam, 2 to 6 percent slopes
DeA	Derinda silt loam, 0 to 2 percent slopes
DeB	Derinda silt loam, 2 to 6 percent slopes
DeB2	Derinda silt loam, 2 to 6 percent slopes, moderately eroded
DeC	Derinda silt loam, 6 to 12 percent slopes
DeC2	Derinda silt loam, 6 to 12 percent slopes, moderately eroded
DeD	Derinda silt loam, 12 to 20 percent slopes
DeD2	Derinda silt loam, 12 to 20 percent slopes, moderately eroded
DeE	Derinda silt loam, 20 to 30 percent slopes
DfC2	Derinda silt loam, acid variant, 6 to 12 percent slopes, moderately eroded
DfD2	Derinda silt loam, acid variant, 12 to 20 percent slopes, eroded
DkB2	Dickinson fine sandy loam, 2 to 6 percent slopes, moderately eroded
DoB	Downs silt loam, 2 to 6 percent slopes
DoB2	Downs silt loam, 2 to 6 percent slopes, moderately eroded
DoC2	Downs silt loam, 6 to 12 percent slopes, moderately eroded
DsA	Dubuque silt loam, 0 to 2 percent slopes
DsB	Dubuque silt loam, 2 to 6 percent slopes
DsB2	Dubuque silt loam, 2 to 6 percent slopes, moderately eroded
DsC	Dubuque silt loam, 6 to 12 percent slopes
DsC2	Dubuque silt loam, 6 to 12 percent slopes, moderately eroded
DsD	Dubuque silt loam, 12 to 20 percent slopes
DsD2	Dubuque silt loam, 12 to 20 percent slopes, moderately eroded
DsE	Dubuque silt loam, 20 to 30 percent slopes
DsE2	Dubuque silt loam, 20 to 30 percent slopes, moderately eroded
DsF	Dubuque silt loam, 30 to 40 percent slopes
DtB3	Dubuque soils, 2 to 6 percent slopes, severely eroded
DtC3	Dubuque soils, 6 to 12 percent slopes, severely eroded
DtD3	Dubuque soils, 12 to 20 percent slopes, severely eroded
DuB	Dunbarton silt loam, 2 to 6 percent slopes
DuB2	Dunbarton silt loam, 2 to 6 percent slopes, moderately eroded
DuC	Dunbarton silt loam, 6 to 12 percent slopes
DuC2	Dunbarton silt loam, 6 to 12 percent slopes, moderately eroded
DuD	Dunbarton silt loam, 12 to 20 percent slopes
DuD2	Dunbarton silt loam, 12 to 20 percent slopes, moderately eroded
DuE	Dunbarton silt loam, 20 to 30 percent slopes
DuE2	Dunbarton silt loam, 20 to 30 percent slopes, moderately eroded
DvC	Dunbarton complex, 6 to 12 percent slopes
DvC2	Dunbarton complex, 6 to 12 percent slopes, moderately eroded

SYMBOL	NAME
DvD	Dunbarton complex, 12 to 20 percent slopes
DvD2	Dunbarton complex, 12 to 20 percent slopes, moderately eroded
DvE	Dunbarton complex, 20 to 30 percent slopes
DvE2	Dunbarton complex, 20 to 30 percent slopes, moderately eroded
EdC2	Edith soils, 6 to 12 percent slopes, eroded
EdD	Edith soils, 12 to 20 percent slopes
EdD2	Edith soils, 12 to 20 percent slopes, moderately eroded
EdE	Edith soils, 20 to 30 percent slopes
EwC2	Edith–Wykoff soils, 6 to 12 percent slopes, eroded
EwD2	Edith–Wykoff soils, 12 to 20 percent slopes, eroded
EwD3	Edith–Wykoff soils, 12 to 20 percent slopes, severely eroded
EwE	Edith–Wykoff soils, 20 to 30 percent slopes
FaA	Fayette silt loam, benches, 0 to 2 percent slopes
FaB	Fayette silt loam, benches, 2 to 6 percent slopes
FaC2	Fayette silt loam, benches, 6 to 12 percent slopes, moderately eroded
FlB	Floyd silt loam, 2 to 6 percent slopes
FnB2	Freeon silt loam, 2 to 6 percent slopes, moderately eroded
FnC2	Freeon silt loam, 6 to 12 percent slopes, moderately eroded
Fr	Freer silt loam
GaB	Gale silt loam, 2 to 6 percent slopes
GaB2	Gale silt loam, 2 to 6 percent slopes, moderately eroded
GaC2	Gale silt loam, 6 to 12 percent slopes, eroded
GaD2	Gale silt loam, 12 to 20 percent slopes, moderately eroded
GtC2	Gale silt loam, thin solum variant, 6 to 12 percent slopes, eroded
GtD	Gale silt loam, thin solum variant, 12 to 20 percent slopes
GtD2	Gale silt loam, thin solum variant, 12 to 20 percent slopes, moderately eroded
GtE	Gale silt loam, thin solum variant, 20 to 30 percent slopes
HaA	Halder loam, 0 to 2 percent slopes
HdA	Halder loam, sandy substratum, 0 to 3 percent slopes
HeB2	Hesch fine sandy loam, loamy substratum, 2 to 6 percent slopes, moderately eroded
HeC2	Hesch fine sandy loam, loamy substratum, 6 to 12 percent slopes, moderately eroded
HeD2	Hesch fine sandy loam, loamy substratum, 12 to 20 percent slopes, eroded
HlB	Hesch loam, loamy substratum, 2 to 6 percent slopes
HlB2	Hesch loam, loamy substratum, 2 to 6 percent slopes, moderately eroded
HlC2	Hesch loam, loamy substratum, 6 to 12 percent slopes, moderately eroded
HlD2	Hesch loam, loamy substratum, 12 to 20 percent slopes, moderately eroded
HmC2	Hixton fine sandy loam, 6 to 12 percent slopes, moderately eroded
HmD2	Hixton fine sandy loam, 12 to 20 percent slopes, moderately eroded
HnB	Hixton fine sandy loam, loamy substratum, 2 to 6 percent slopes
HnB2	Hixton fine sandy loam, loamy substratum, 2 to 6 percent slopes, moderately eroded
HnC	Hixton fine sandy loam, loamy substratum, 6 to 12 percent slopes
HnC2	Hixton fine sandy loam, loamy substratum, 6 to 12 percent slopes, moderately eroded
HnD	Hixton fine sandy loam, loamy substratum, 12 to 20 percent slopes
HnD2	Hixton fine sandy loam, loamy substratum, 12 to 20 percent slopes, moderately eroded
HnE	Hixton fine sandy loam, loamy substratum, 20 to 30 percent slopes
HtB	Hixton loam, loamy substratum, 2 to 6 percent slopes
HtC2	Hixton loam, loamy substratum, 6 to 12 percent slopes, moderately eroded
HtD2	Hixton loam, loamy substratum, 12 to 20 percent slopes, eroded
LaB2	Lamont very fine sandy loam, 2 to 6 percent slopes, moderately eroded
LaC2	Lamont very fine sandy loam, 6 to 12 percent slopes, moderately eroded
LaD2	Lamont very fine sandy loam, 12 to 20 percent slopes, moderately eroded
LcA	Lawler loam, 0 to 3 percent slopes
LwA	Lawler silt loam, 0 to 2 percent slopes
LwB	Lawler silt loam, 2 to 6 percent slopes
MdA	Meridian loam, 0 to 2 percent slopes
MdB	Meridian loam, 2 to 6 percent slopes

SYMBOL	NAME
OmA	Onamia loam, 0 to 2 percent slopes
OmB	Onamia loam, 2 to 6 percent slopes
OmB2	Onamia loam, 2 to 6 percent slopes, moderately eroded
OmC2	Onamia loam, 6 to 12 percent slopes, moderately eroded
OmD2	Onamia loam, 12 to 20 percent slopes, moderately eroded
OnB	Onamia sandy loam, 2 to 6 percent slopes
OnC2	Onamia sandy loam, 6 to 12 percent slopes, moderately eroded
Or	Orion silt loam
OsA	Ostrander silt loam, 0 to 2 percent slopes
OsB	Ostrander silt loam, 2 to 6 percent slopes
OsB2	Ostrander silt loam, 2 to 6 percent slopes, moderately eroded
OsC2	Ostrander silt loam, 6 to 12 percent slopes, moderately eroded
OtB	Otterholt silt loam, 2 to 6 percent slopes
OtB2	Otterholt silt loam, 2 to 6 percent slopes, moderately eroded
OtC	Otterholt silt loam, 6 to 12 percent slopes
OtC2	Otterholt silt loam, 6 to 12 percent slopes, moderately eroded
OtC3	Otterholt silt loam, 6 to 12 percent slopes, severely eroded
OtD2	Otterholt silt loam, 12 to 20 percent slopes, moderately eroded
PmA	Plainfield loamy sand, 0 to 2 percent slopes
PmB	Plainfield loamy sand, 2 to 6 percent slopes
PmB2	Plainfield loamy sand, 2 to 6 percent slopes, eroded
PmC	Plainfield loamy sand, 6 to 12 percent slopes
PmC2	Plainfield loamy sand, 6 to 12 percent slopes, eroded
PoA	Port Byron silt loam, 0 to 2 percent slopes
PoB	Port Byron silt loam, 2 to 6 percent slopes
PoC2	Port Byron silt loam, 6 to 12 percent slopes, moderately eroded
RaB	Racine silt loam, 2 to 6 percent slopes
RaB2	Racine silt loam, 2 to 6 percent slopes, moderately eroded
RaC2	Racine silt loam, 6 to 12 percent slopes, moderately eroded
ReA	Renova silt loam, 0 to 2 percent slopes
ReB	Renova silt loam, 2 to 6 percent slopes
ReB2	Renova silt loam, 2 to 6 percent slopes, moderately eroded
ReC	Renova silt loam, 6 to 12 percent slopes
ReC2	Renova silt loam, 6 to 12 percent slopes, moderately eroded
ReC3	Renova silt loam, 6 to 12 percent slopes, severely eroded
ReD	Renova silt loam, 12 to 20 percent slopes
ReD2	Renova silt loam, 12 to 20 percent slopes, moderately eroded
ReD3	Renova silt loam, 12 to 20 percent slopes, severely eroded
RfB2	Renova fine sandy loam, sandy variant, 2 to 6 percent slopes, eroded
RfC2	Renova fine sandy loam, sandy variant, 6 to 12 percent slopes, eroded
RfD2	Renova fine sandy loam, sandy variant, 12 to 20 percent slopes, eroded
Rh	Riverwash
RoB	Rockton complex, 2 to 6 percent slopes
RoC2	Rockton complex, 6 to 12 percent slopes, moderately eroded
RtA	Rozetta silt loam, benches, 0 to 2 percent slopes
RtB	Rozetta silt loam, benches, 2 to 6 percent slopes
Sa	Sable silt loam
SbB	Santiago silt loam, 2 to 6 percent slopes
SbB2	Santiago silt loam, 2 to 6 percent slopes, moderately eroded
SbC2	Santiago silt loam, 6 to 12 percent slopes, moderately eroded
SgA	Sargeant silt loam, 0 to 2 percent slopes
SgB	Sargeant silt loam, 2 to 6 percent slopes
SgB2	Sargeant silt loam, 2 to 6 percent slopes, moderately eroded
SgC	Sargeant silt loam, 6 to 12 percent slopes
SgC2	Sargeant silt loam, 6 to 12 percent slopes, moderately eroded
ShC	Schapville silt loam, 6 to 12 percent slopes
ShC2	Schapville silt loam, 6 to 12 percent slopes, moderately eroded
ShD2	Schapville silt loam, 12 to 20 percent slopes, moderately eroded
ShE2	Schapville silt loam, 20 to 30 percent slopes, eroded
SkB2	Schapville silt loam, wet subsoil variant, 2 to 6 percent slopes, eroded
SnB	Seaton silt loam, 2 to 6 percent slopes
SnB2	Seaton silt loam, 2 to 6 percent slopes, moderately eroded
SnC	Seaton silt loam, 6 to 12 percent slopes
SnC2	Seaton silt loam, 6 to 12 percent slopes, moderately eroded
SnC3	Seaton silt loam, 6 to 12 percent slopes, severely eroded
SnD	Seaton silt loam, 12 to 20 percent slopes
SnD2	Seaton silt loam, 12 to 20 percent slopes, moderately eroded
SnD3	Seaton silt loam, 12 to 20 percent slopes, severely eroded
SnE	Seaton silt loam, 20 to 30 percent slopes
SnE2	Seaton silt loam, 20 to 30 percent slopes, moderately eroded

SYMBOL	NAME
SoA	Sogn–Rockton loams, 0 to 2 percent slopes
SoB	Sogn–Rockton loams, 2 to 6 percent slopes
SoC2	Sogn–Rockton loams, 6 to 12 percent slopes, moderately eroded
SoD2	Sogn–Rockton loams, 12 to 20 percent slopes, moderately eroded
SpA	Sparta loamy sand, 0 to 2 percent slopes
SpB	Sparta loamy sand, 2 to 6 percent slopes
SpB2	Sparta loamy sand, 2 to 6 percent slopes, eroded
SpC2	Sparta loamy sand, 6 to 12 percent slopes, eroded
SrA	Spencer silt loam, 0 to 2 percent slopes
SrB	Spencer silt loam, 2 to 6 percent slopes
SrB2	Spencer silt loam, 2 to 6 percent slopes, moderately eroded
SrC2	Spencer silt loam, 6 to 12 percent slopes, moderately eroded
StF	Steep stony and rocky land
SuA	Stronghurst silt loam, benches, 0 to 2 percent slopes
TeA	Tell silt loam, 0 to 2 percent slopes
TeB2	Tell silt loam, 2 to 6 percent slopes, eroded
Tl	Terrace escarpments, loamy
Ts	Terrace escarpments, sandy
Tx	Terril loam
VaB	Vlasaty silt loam, 2 to 6 percent slopes
VaB2	Vlasaty silt loam, 2 to 6 percent slopes, moderately eroded
VaC	Vlasaty silt loam, 6 to 12 percent slopes
VaC2	Vlasaty silt loam, 6 to 12 percent slopes, moderately eroded
WaA	Waukegan silt loam, 0 to 2 percent slopes
WaB	Waukegan silt loam, 2 to 6 percent slopes
WhA	Whalan silt loam, 0 to 2 percent slopes
WhB	Whalan silt loam, 2 to 6 percent slopes
WhB2	Whalan silt loam, 2 to 6 percent slopes, moderately eroded
WhC	Whalan silt loam, 6 to 12 percent slopes
WhC2	Whalan silt loam, 6 to 12 percent slopes, moderately eroded
WhD	Whalan silt loam, 12 to 20 percent slopes
WhD2	Whalan silt loam, 12 to 20 percent slopes, moderately eroded
WhD3	Whalan silt loam, 12 to 20 percent slopes, severely eroded
WhE	Whalan silt loam, 20 to 30 percent slopes
WhE2	Whalan silt loam, 20 to 30 percent slopes, moderately eroded
Wn	Worthen silt loam
WoB	Wykoff loam, 2 to 6 percent slopes
WoB2	Wykoff loam, 2 to 6 percent slopes, moderately eroded
WoC	Wykoff loam, 6 to 12 percent slopes
WoC2	Wykoff loam, 6 to 12 percent slopes, moderately eroded
WoC3	Wykoff loam, 6 to 12 percent slopes, severely eroded
WoD	Wykoff loam, 12 to 20 percent slopes
WoD2	Wykoff loam, 12 to 20 percent slopes, moderately eroded
WoD3	Wykoff loam, 12 to 20 percent slopes, severely eroded
WsB	Wykoff silt loam, 2 to 6 percent slopes
WsB2	Wykoff silt loam, 2 to 6 percent slopes, moderately eroded
WsC2	Wykoff silt loam, 6 to 12 percent slopes, eroded

Soil map constructed 1966 by Cartographic Division, Soil Conservation Service, USDA, from 1958 aerial photographs. Controlled mosaic based on Wisconsin plane coordinate system, central zone, Lambert conformal conic projection, 1927 North American datum.

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Range, township, and section corners shown on this map are indefinite.

PIERCE COUNTY, WISCONSIN NO. 1

0 ½ Mile Scale 1:15840 0 3000 Feet

0 ½ Mile Scale 1:15840 0 3000 Feet

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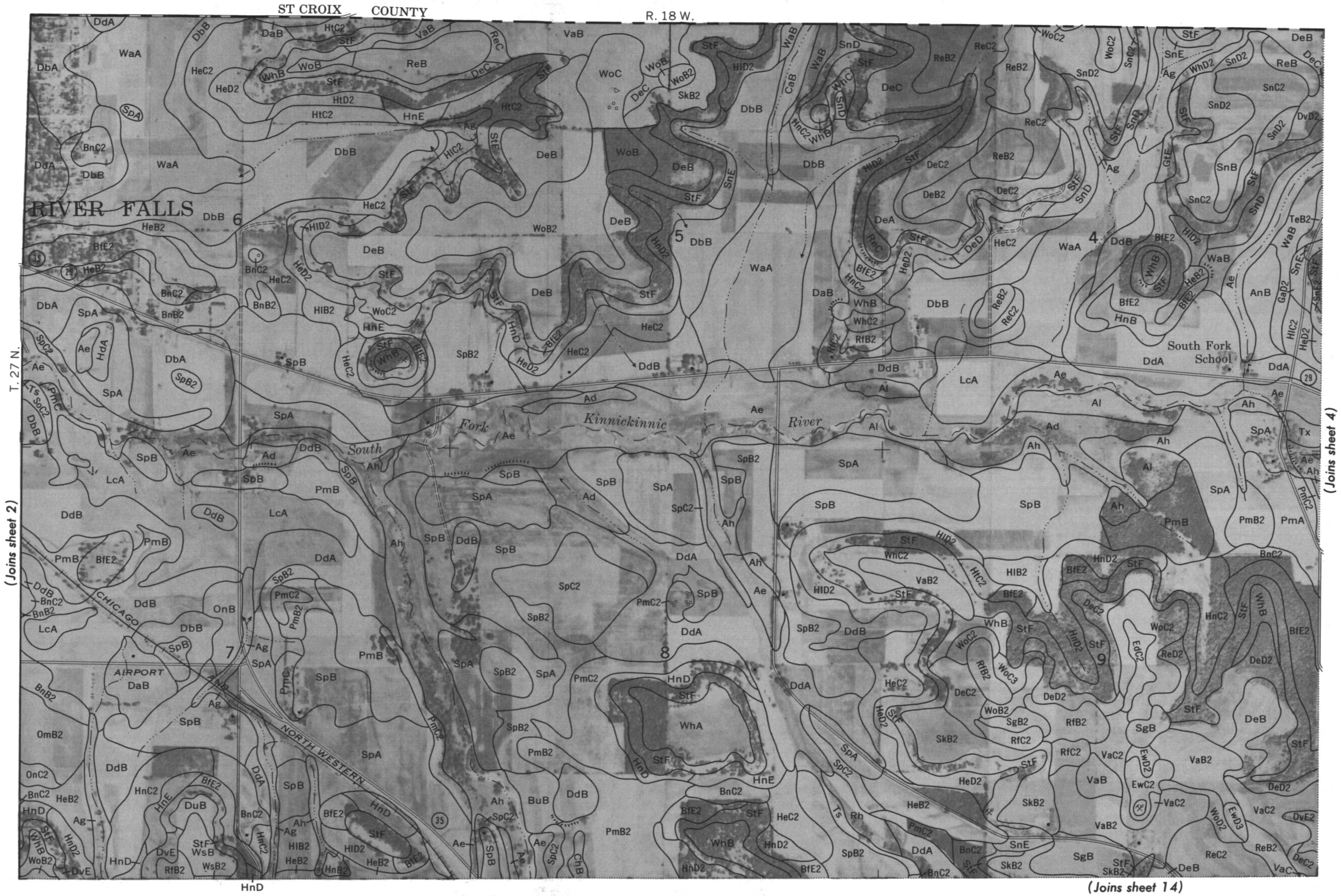
PIERCE COUNTY, WISCONSIN NO. 3

N



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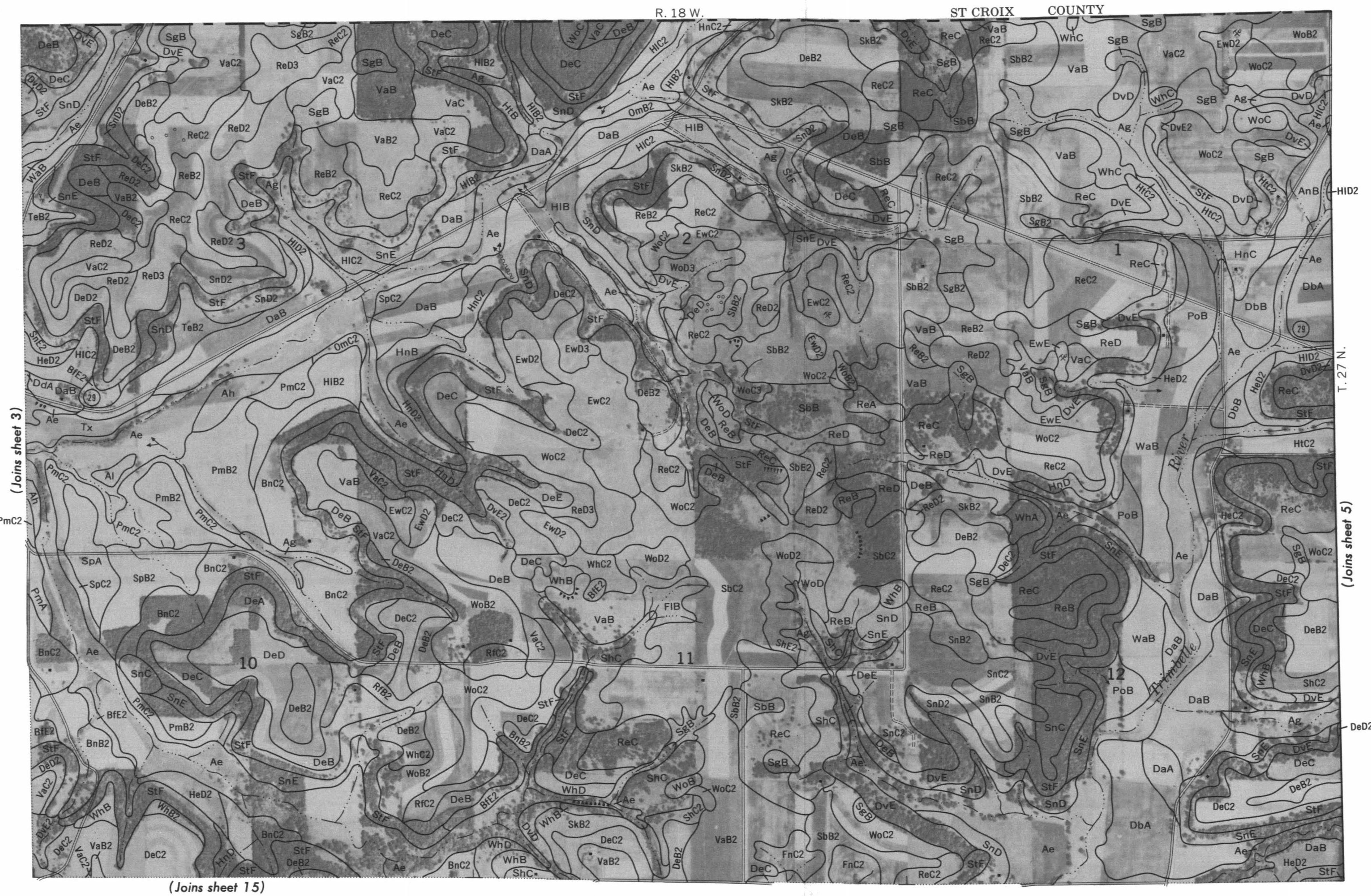

0 ½ Mile Scale 1:15840 0 3000 Feet

0 ½ Mile Scale 1:15840 0 3000 Feet

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PIERCE COUNTY, WISCONSIN NO. 5

⑥

PIERCE COUNTY, WISCONSIN — SHEET NUMBER 6

N

0 ½ Mile Scale 1:15840 0 3000 Feet

PIERCE COUNTY, WISCONSIN NO.6

7

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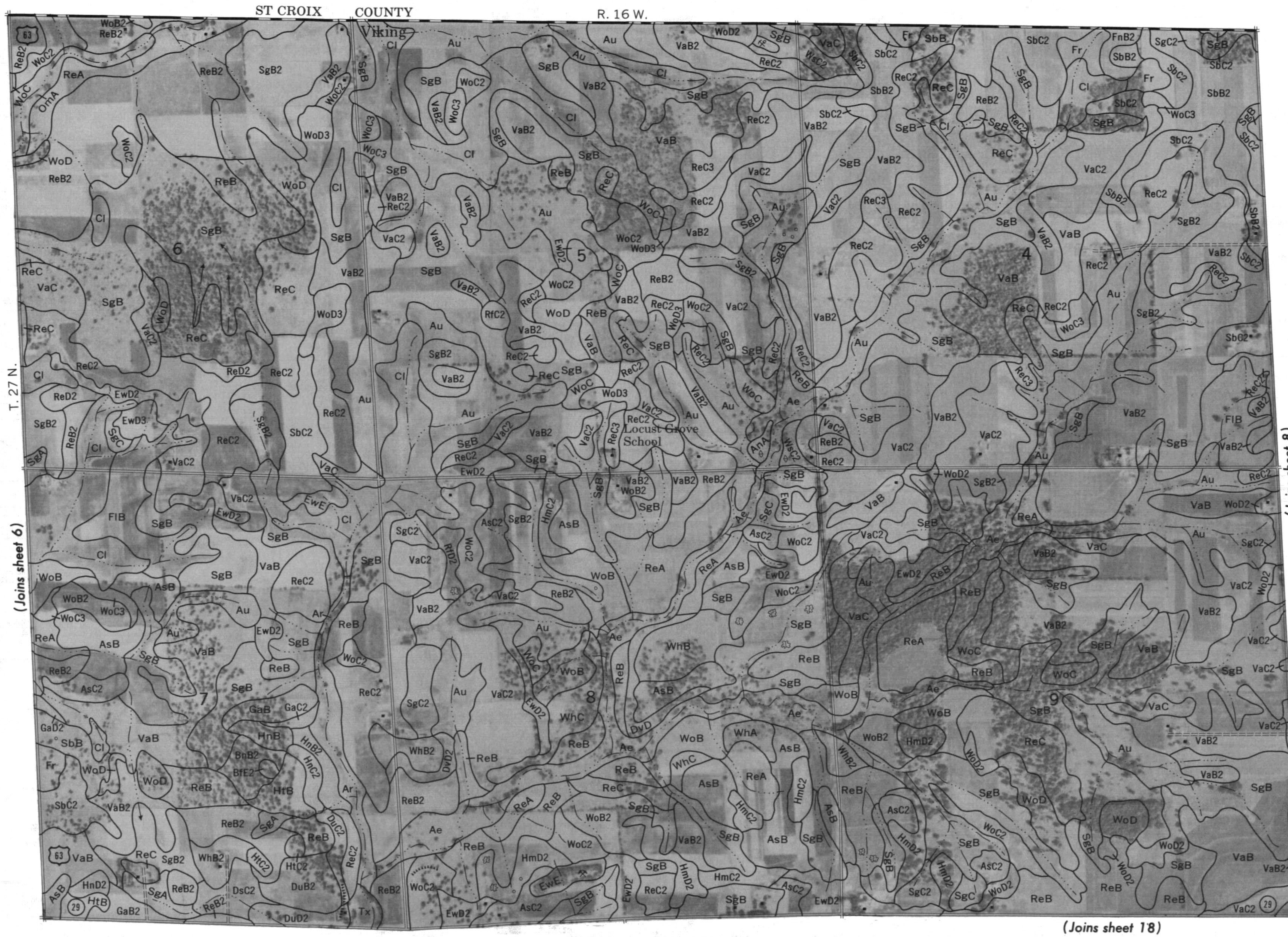
Range, township, and section corners shown on this map are indefinite.

PIERCE COUNTY, WISCONSIN NO. 7

N



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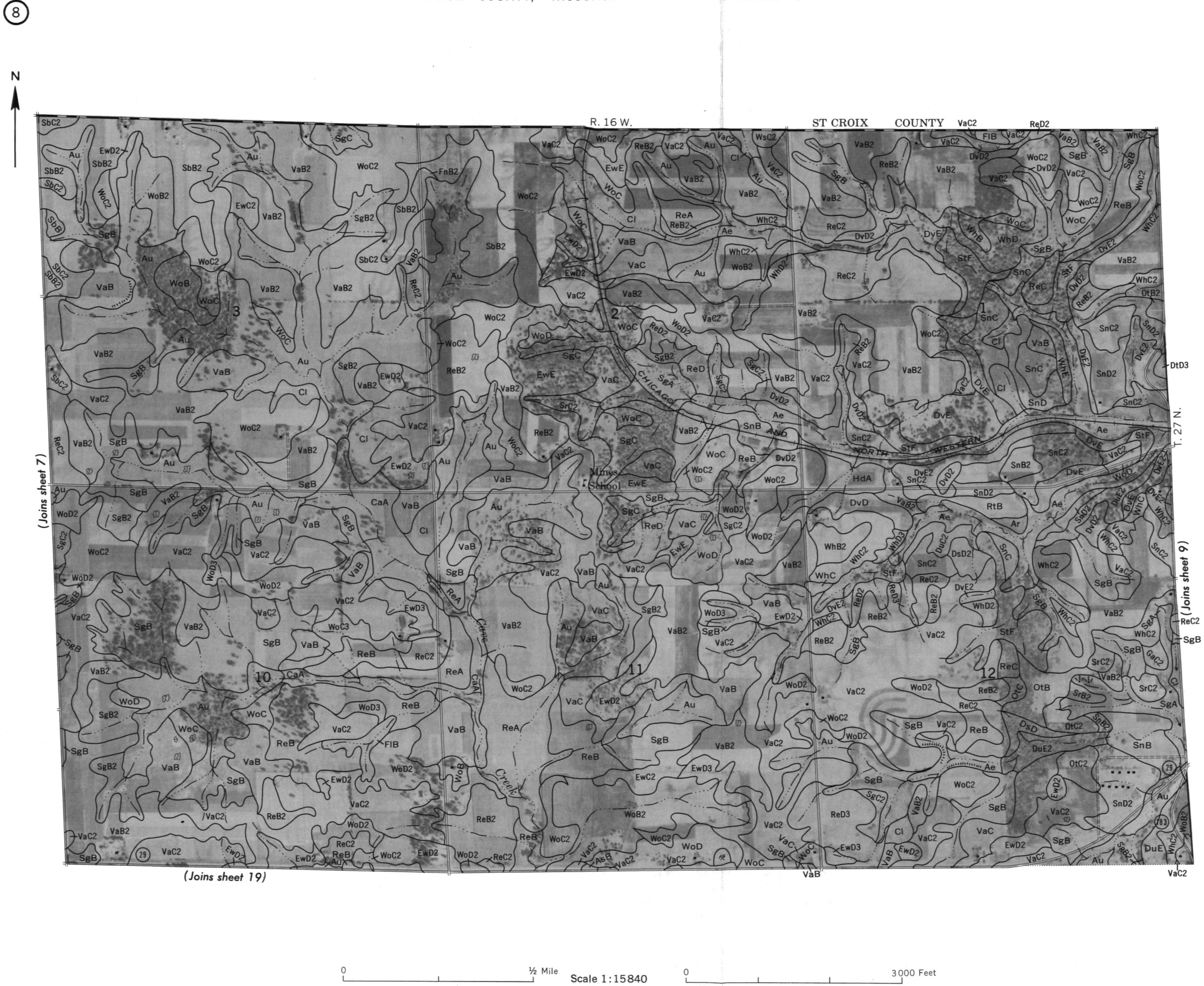
8
N
R. 16 W.
ST CROIX COUNTY
T. 27 N.
(Joins sheet 7)
(Joins sheet 9)
(Joins sheet 19)
CHICAGO AND NORTH WESTERN
Mines School
Cady Creek
0 ½ Mile
Scale 1:15840
0 3000 Feet

N

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Range, township, and section corners shown on this map are indefinite.

PIERCE COUNTY, WISCONSIN NO. 9

0 ½ Mile Scale 1:15840 0 3000 Feet

0 ½ Mile Scale 1:15840 0 3000 Feet

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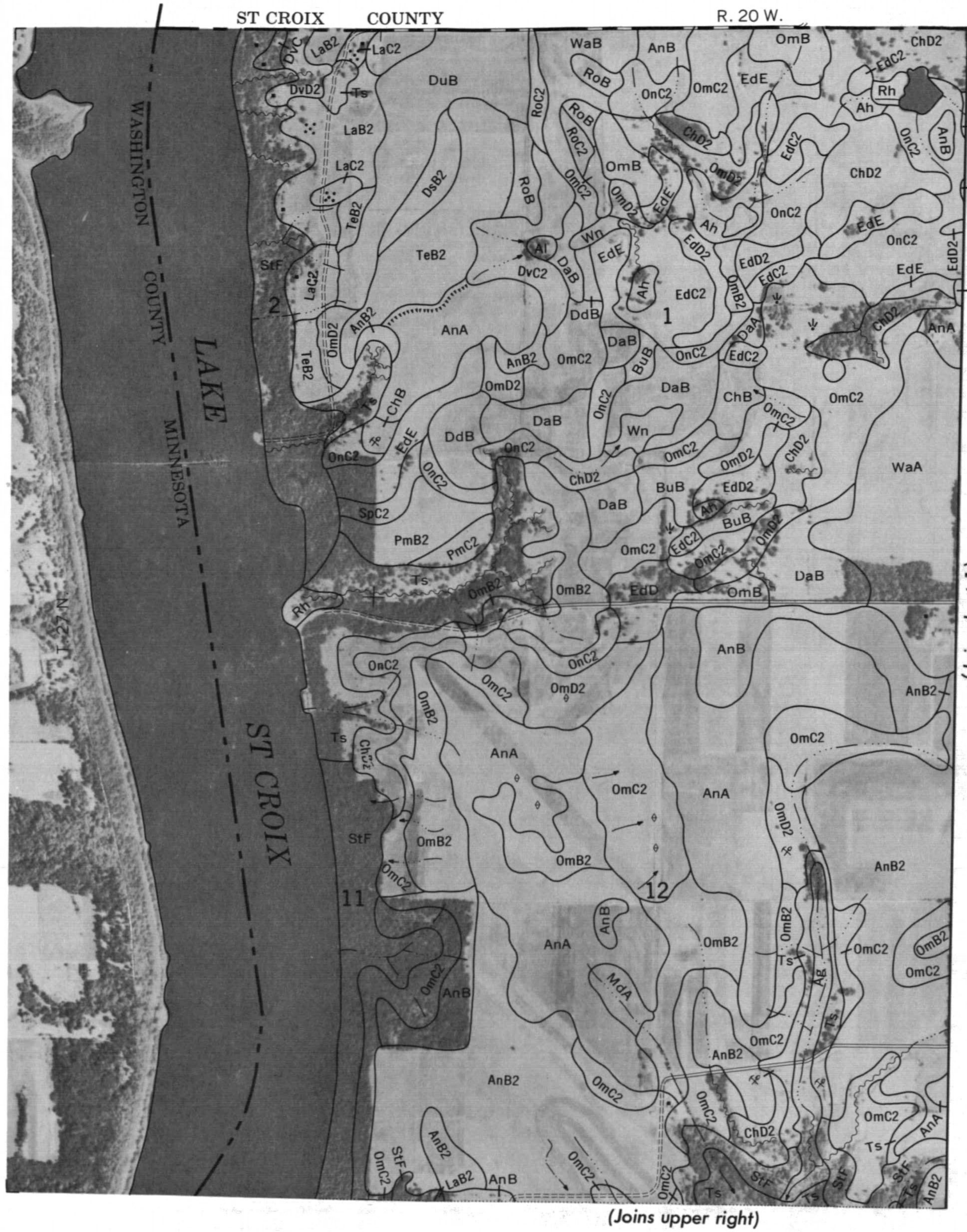
Range, township, and section corners shown on this map are indefinite.

PIERCE COUNTY, WISCONSIN NO. 11



0 ½ Mile Scale 1:15840 0 3000 Feet

N

(Joins sheet 1)

R. 19 W.

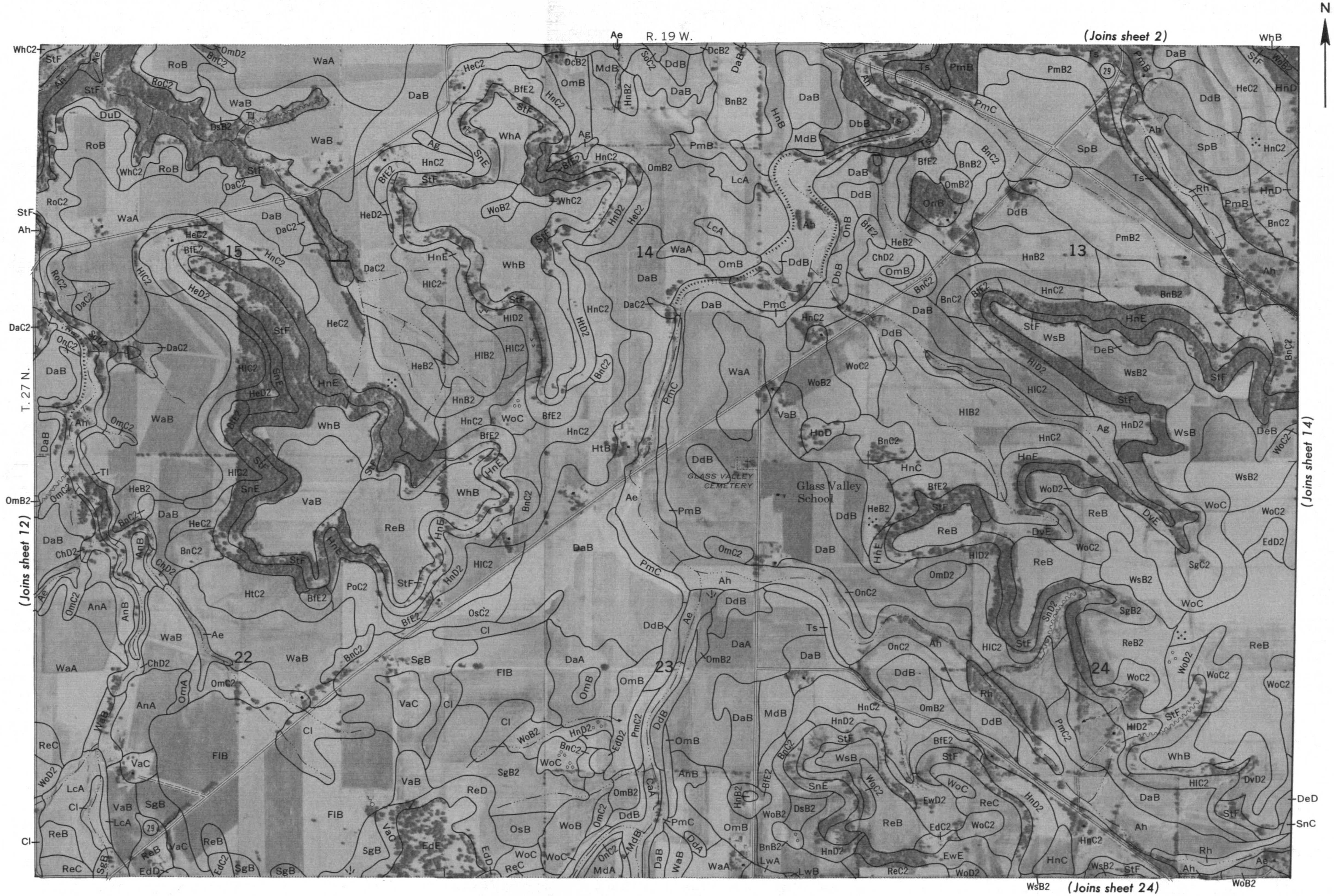
(Joins sheet 11)

T. 27 N.

(Joins sheet 13)

(Joins sheet 23)

0 ½ Mile Scale 1:15840 0 3000 Feet



0 ½ Mile Scale 1:15840 0 3000 Feet

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Range, township, and section corners shown on this map are indefinite.

PIERCE COUNTY, WISCONSIN NO. 13

PIERCE COUNTY, WISCONSIN — SHEET NUMBER 14

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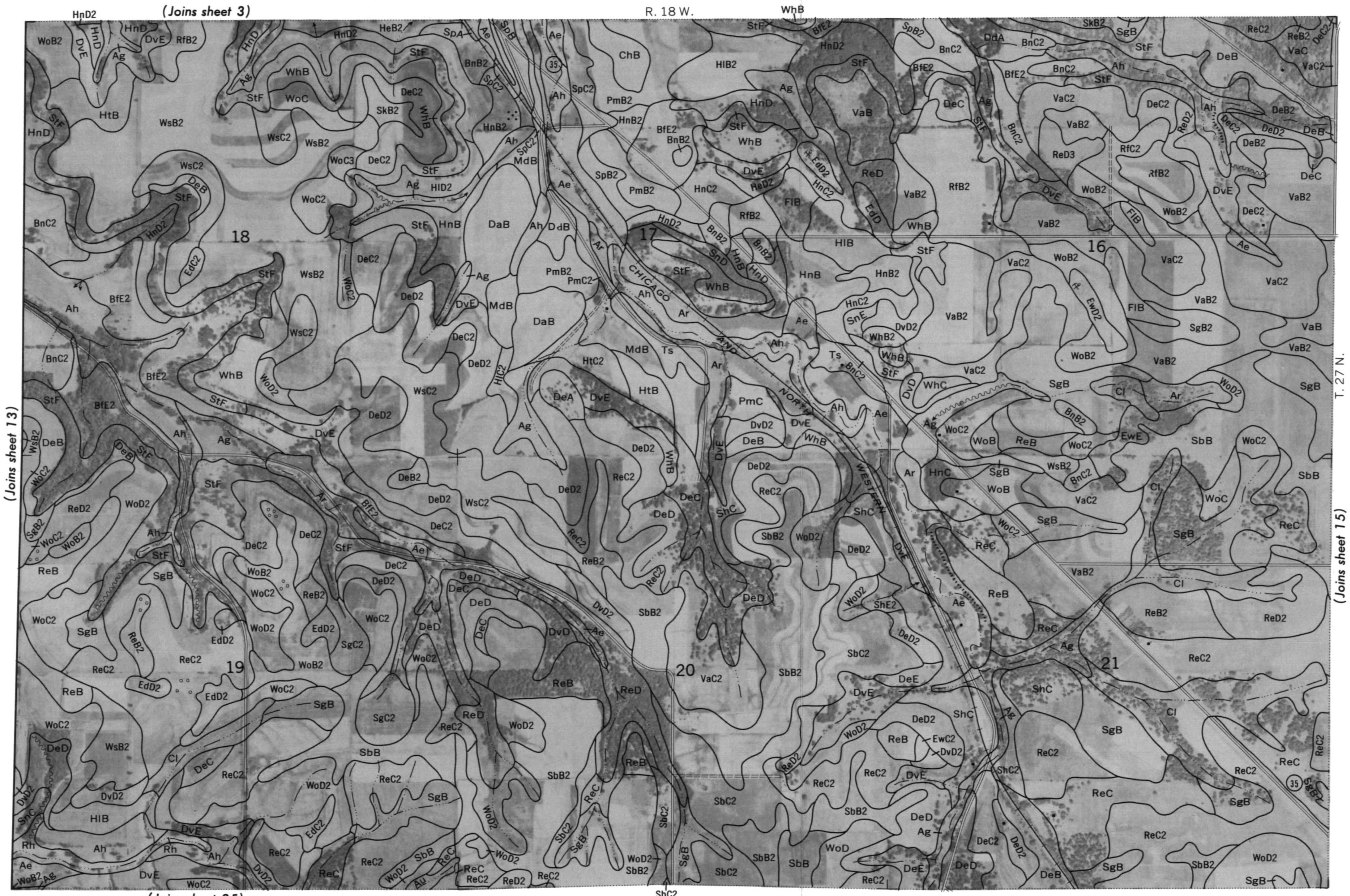

0 ½ Mile Scale 1:15840 0 3000 Feet

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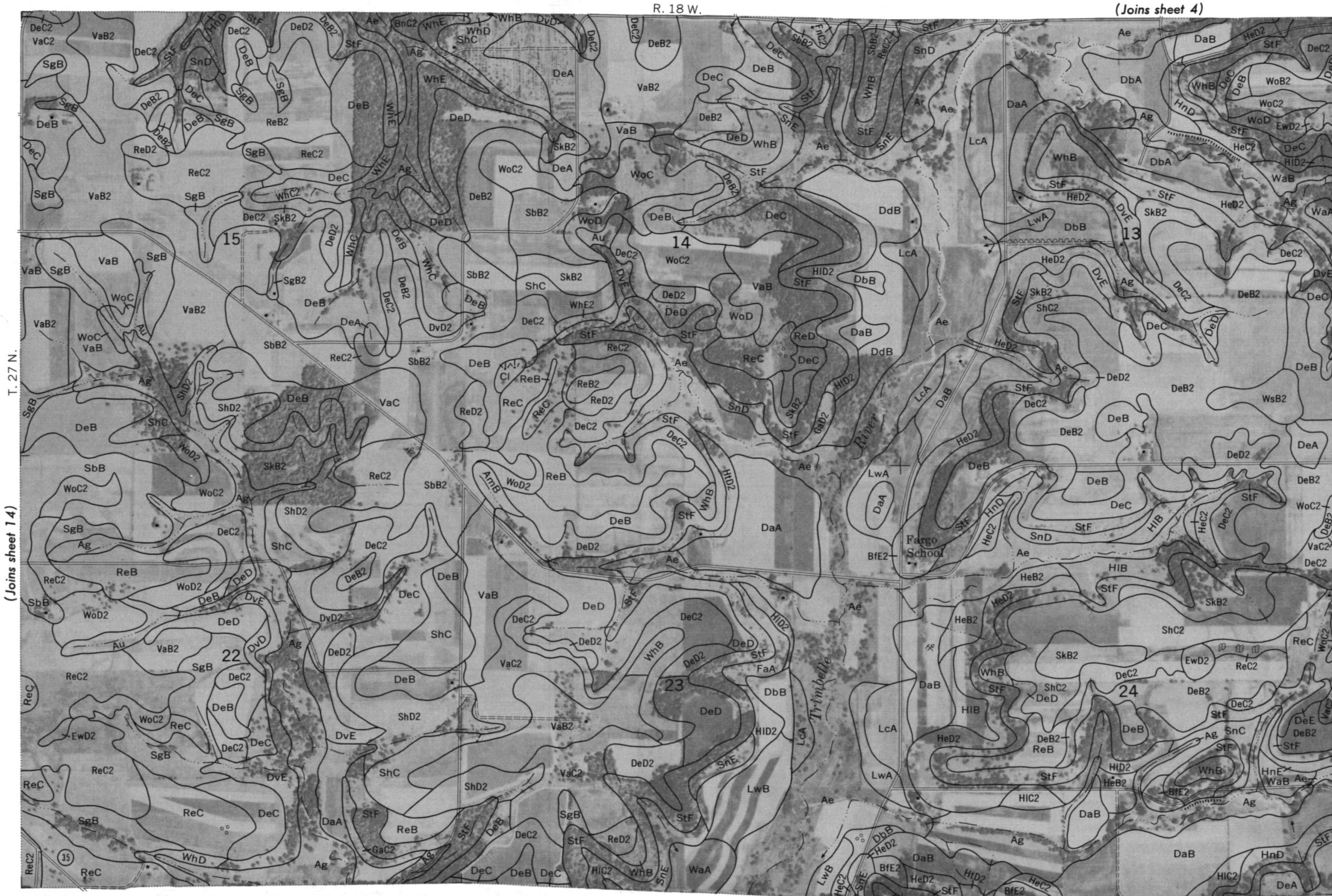
Range, township, and section corners shown on this map are indefinite.

PIERCE COUNTY, WISCONSIN NO. 15



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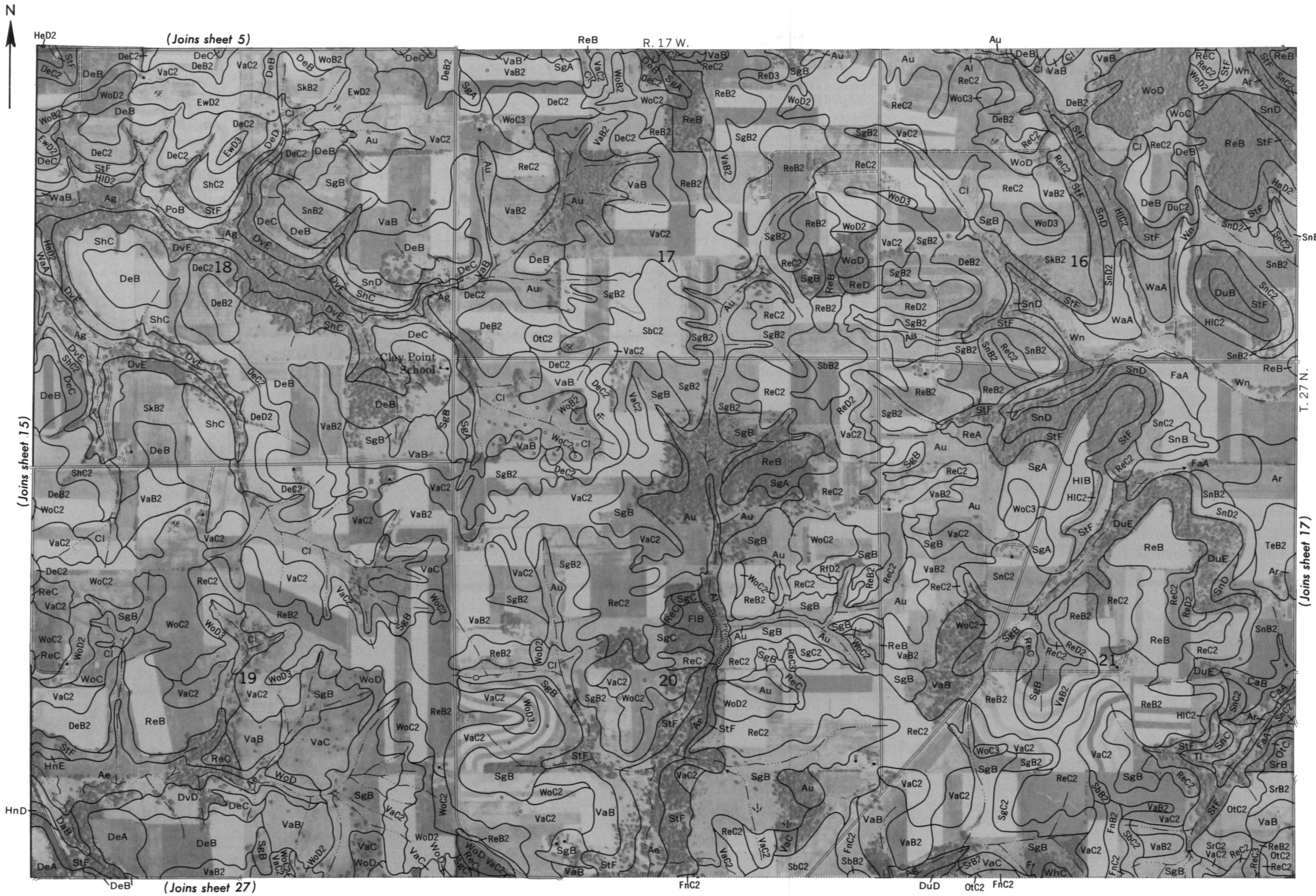
PIERCE COUNTY, WISCONSIN — SHEET NUMBER 16



0 ½ Mile Scale 1:15840 0 3000 Feet

0 ½ Mile Scale 1:15840 0 3000 Feet

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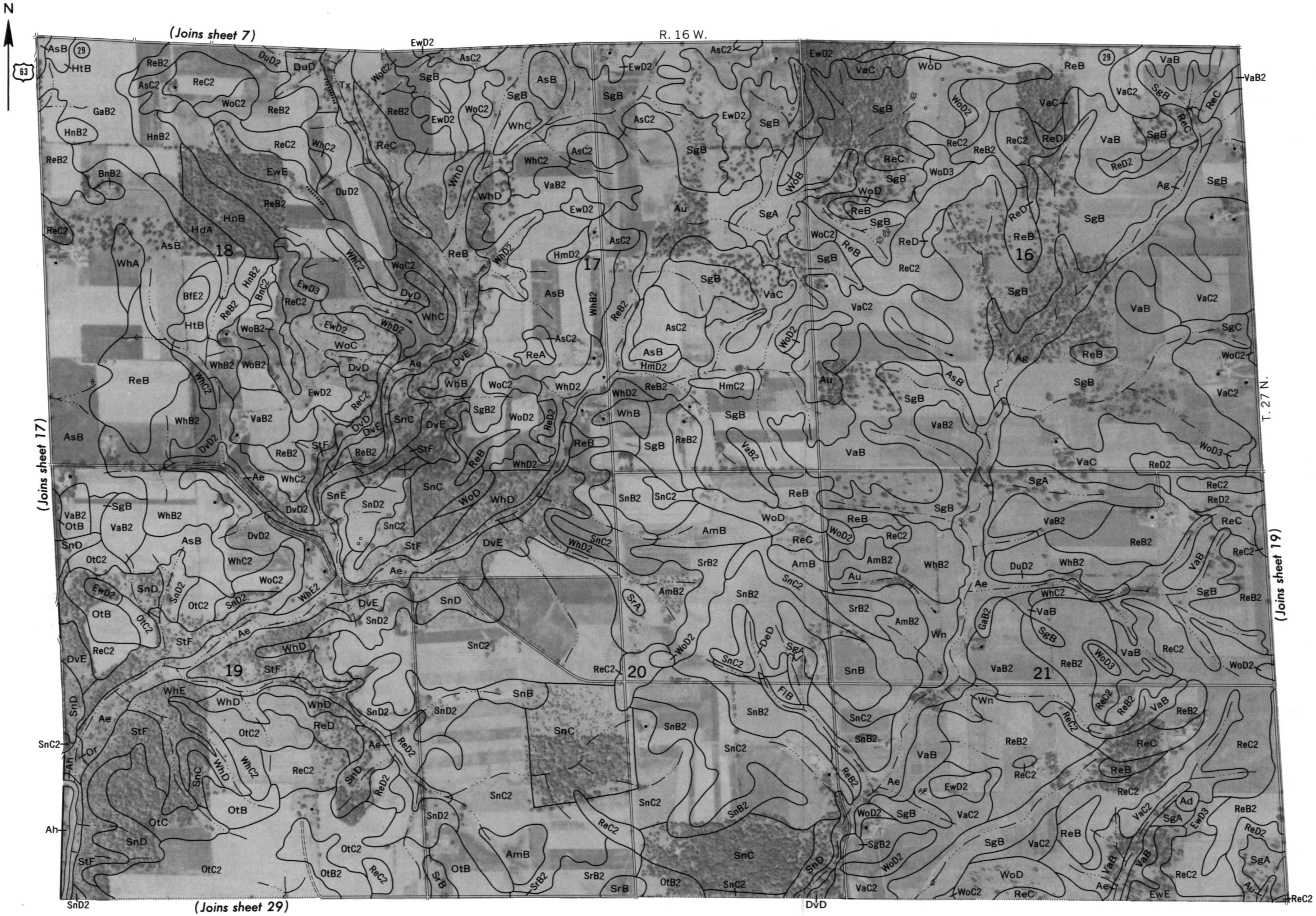
Range, township, and section corners shown on this map are indefinite.



0 ½ Mile Scale 1:15840 0 3000 Feet

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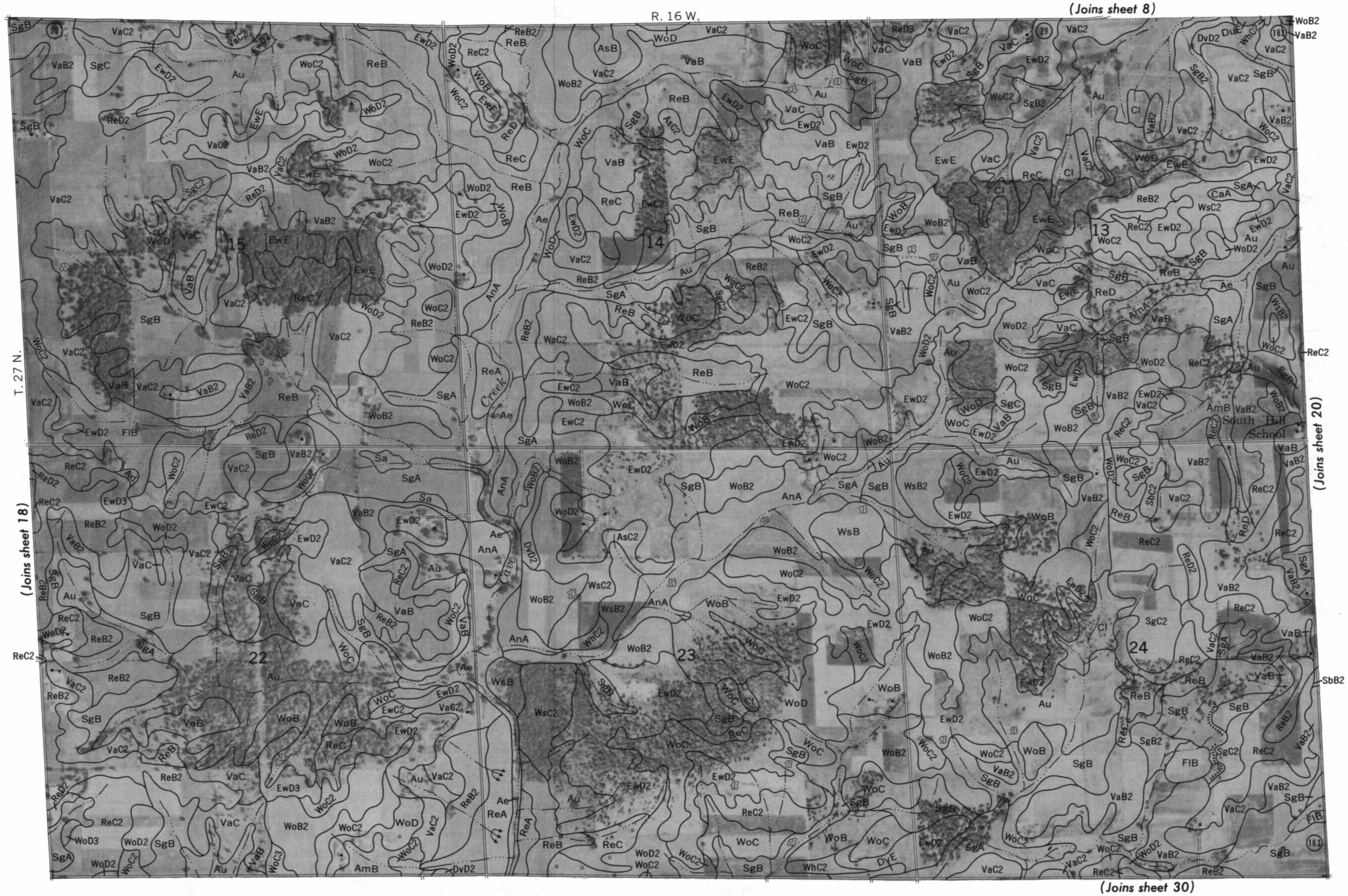
Range, township, and section corners shown on this map are indefinite.

PIERCE COUNTY, WISCONSIN NO.19

N



0 ½ Mile Scale 1:15840 0 3000 Feet

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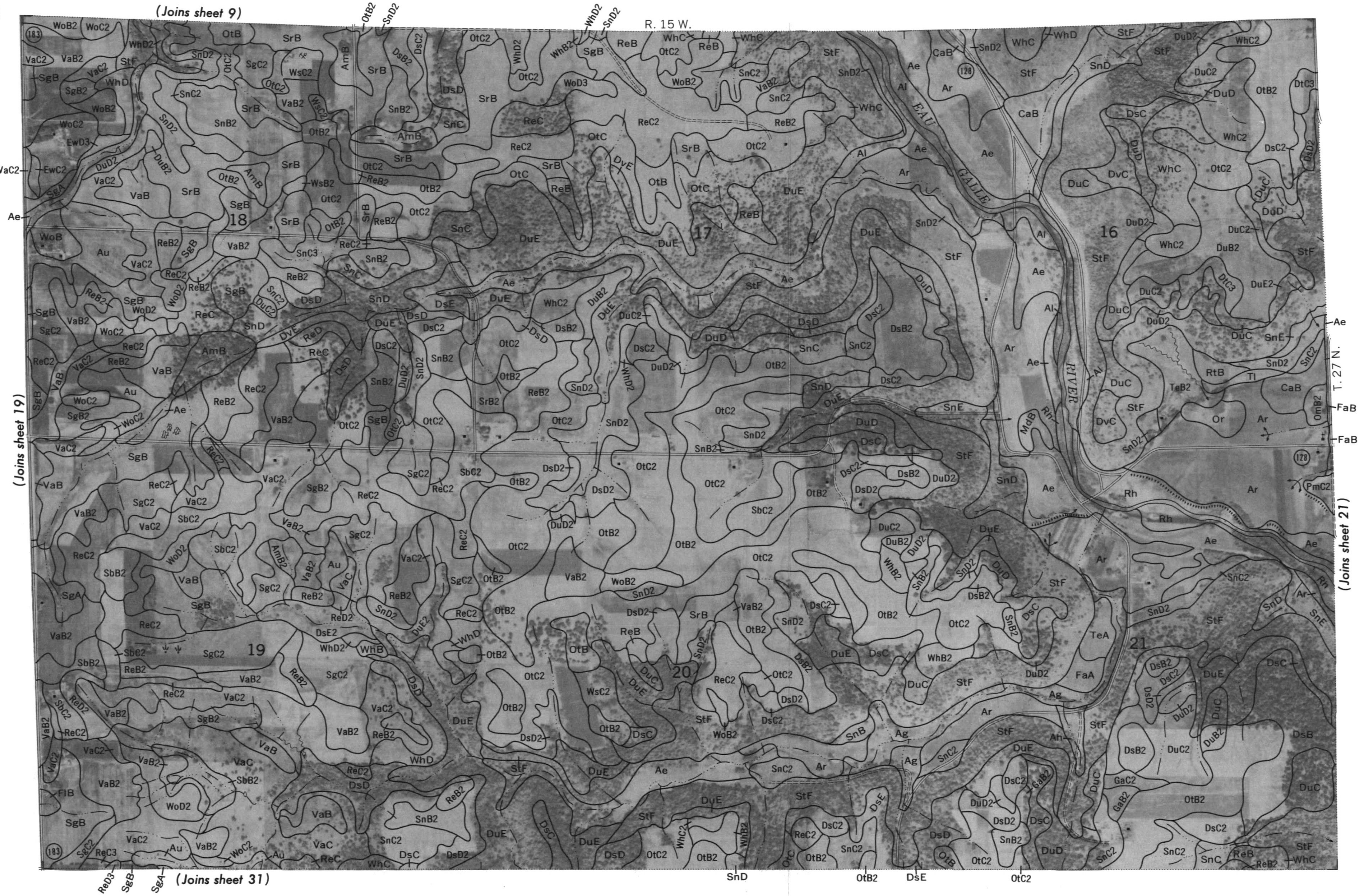

0 ½ Mile Scale 1:15840 0 3000 Feet

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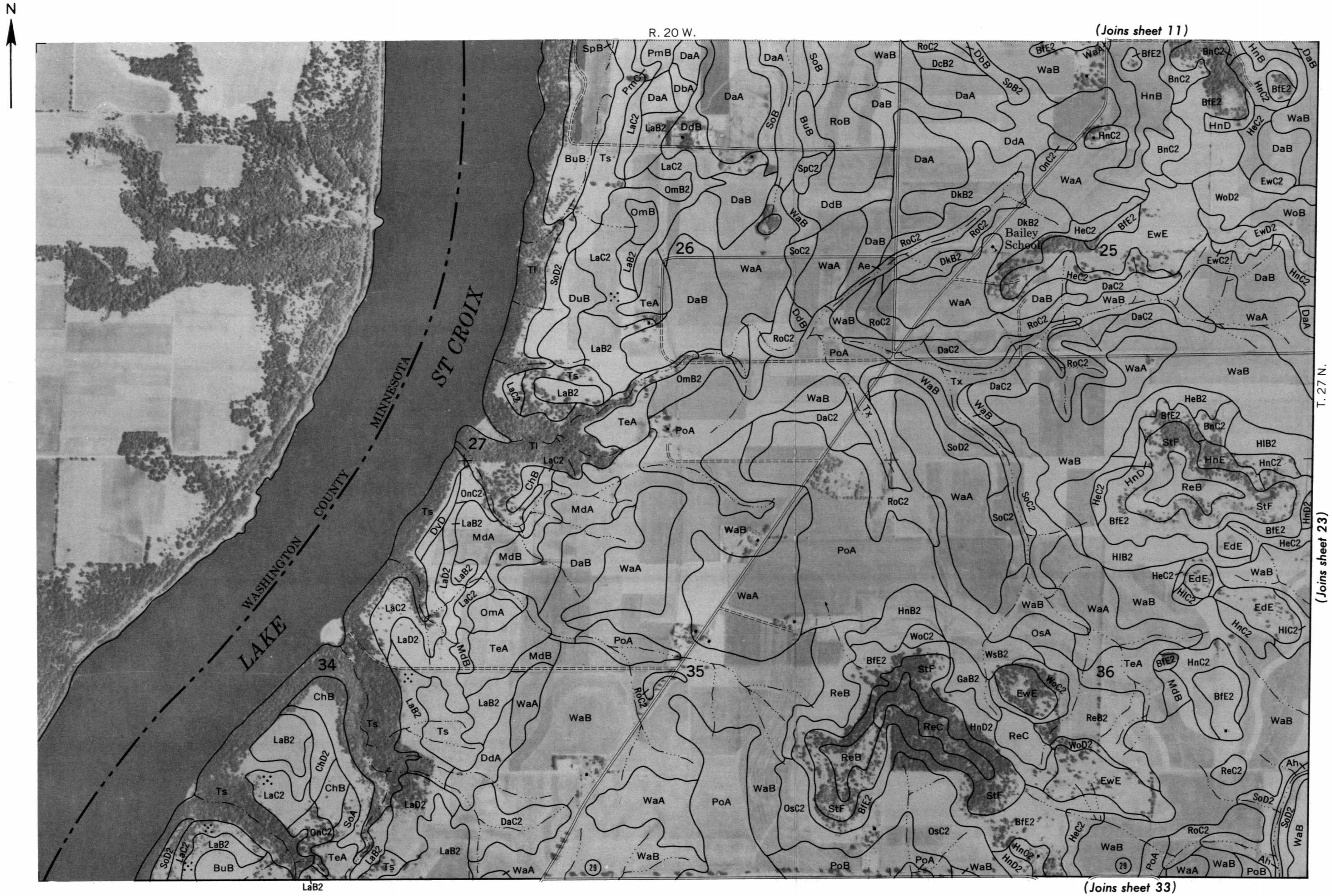
Range, township, and section corners shown on this map are indefinite.

PIERCE COUNTY, WISCONSIN NO. 21

0 ½ Mile Scale 1:15840 0 3000 Feet

PIERCE COUNTY, WISCONSIN — SHEET NUMBER 22



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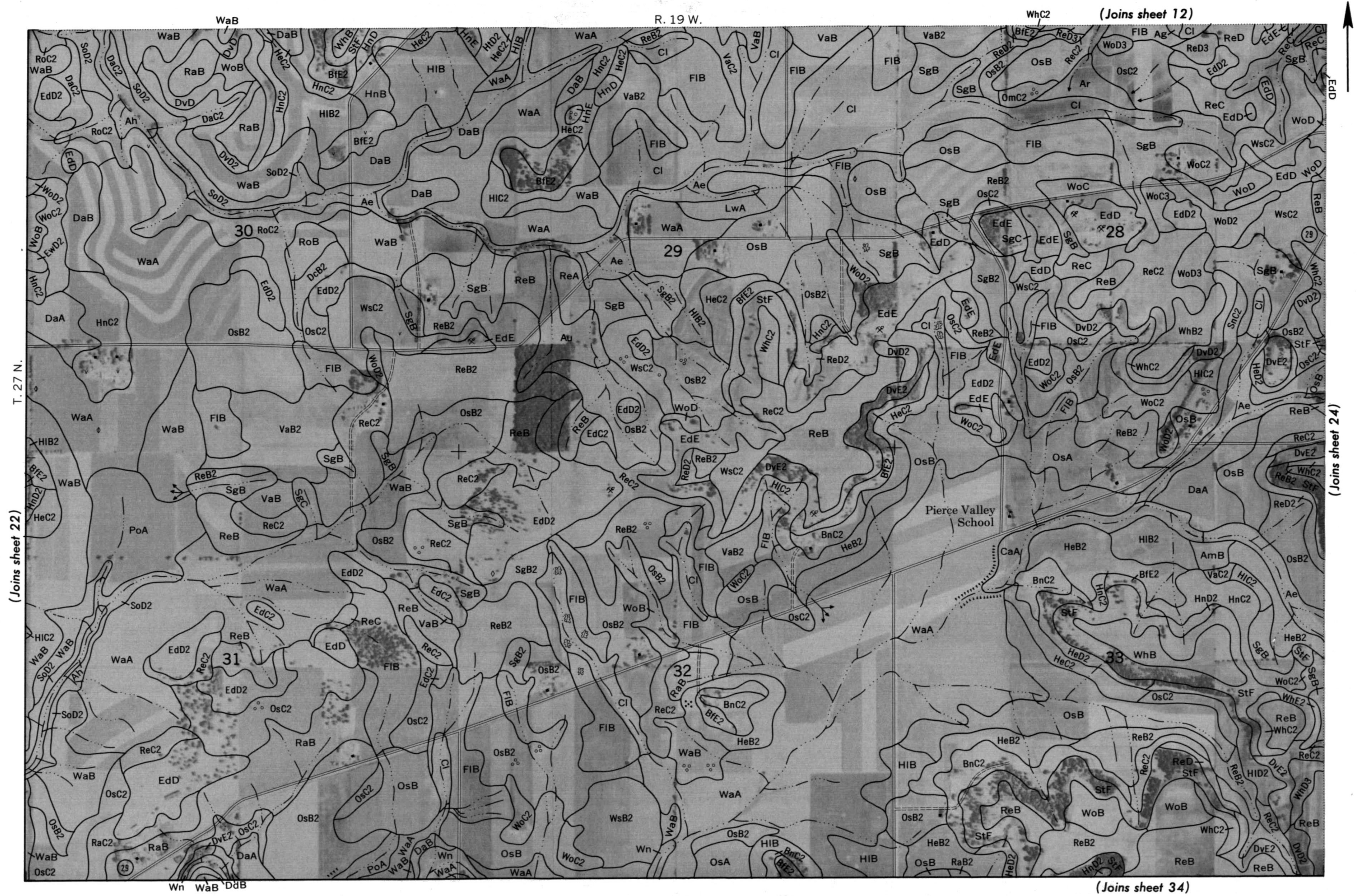

0 ½ Mile Scale 1:15840 0 3000 Feet

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Range, township, and section corners shown on this map are indefinite.

PIERCE COUNTY, WISCONSIN — SHEET NUMBER 24

0 ½ Mile Scale 1:15840 0 3000 Feet

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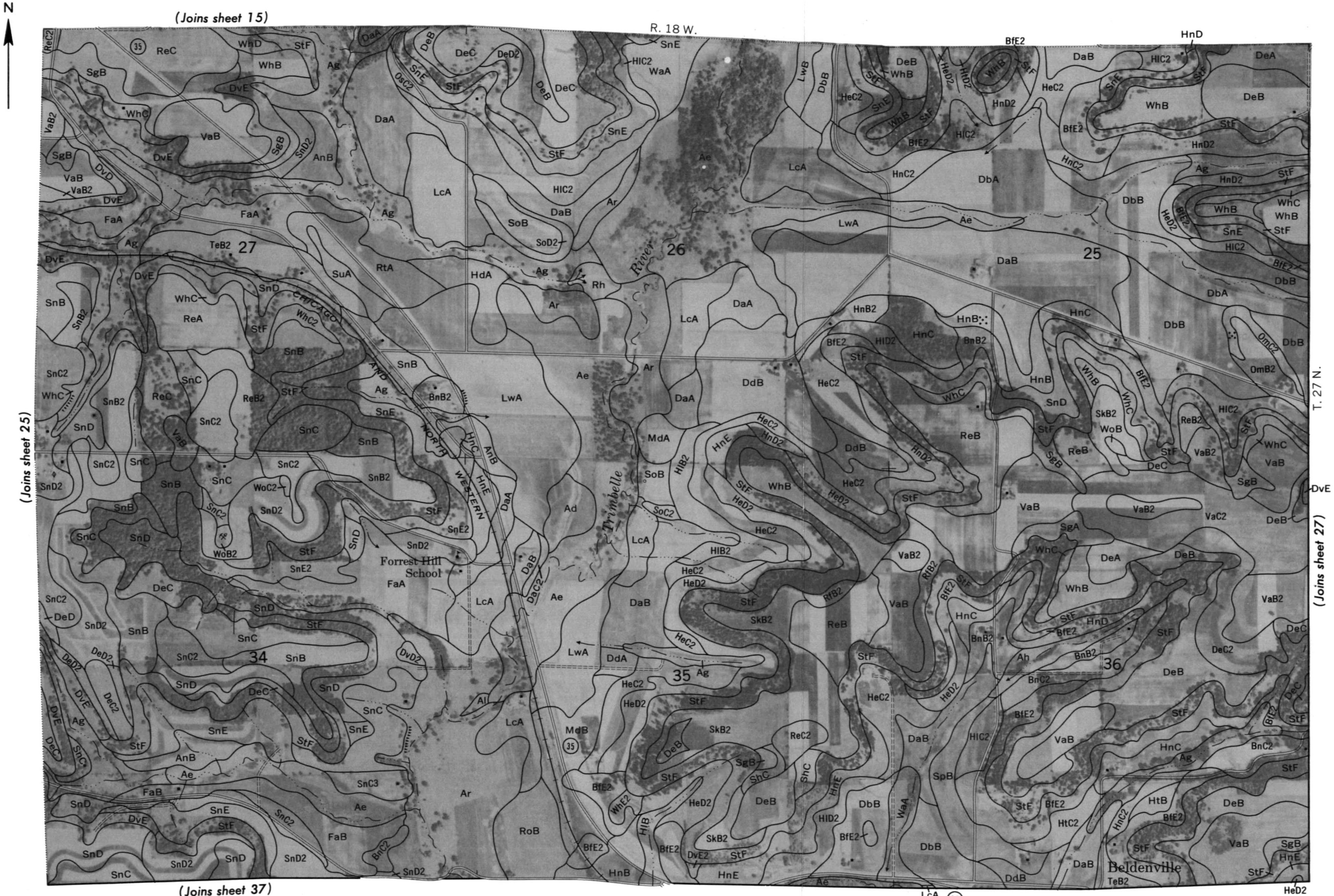
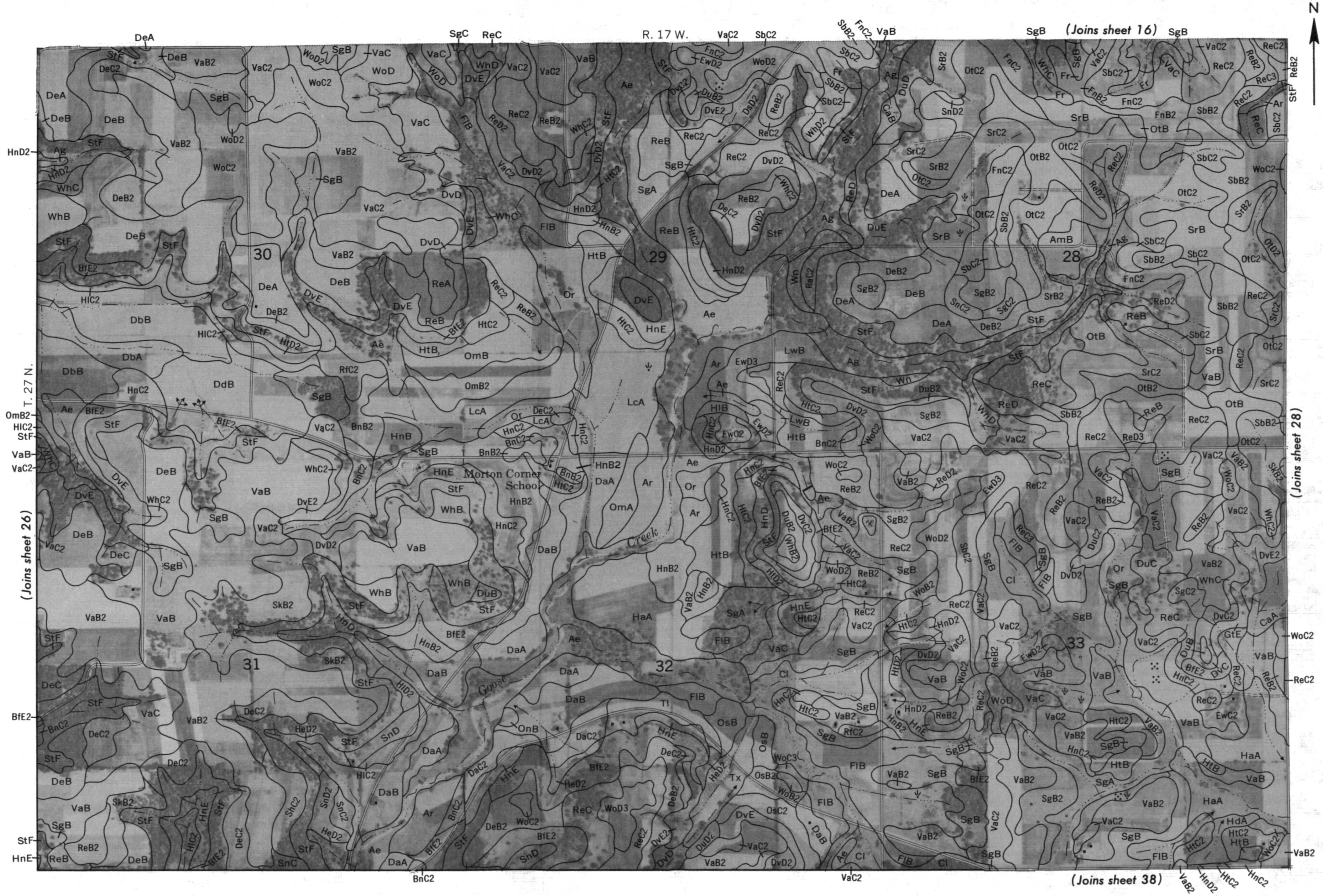
Range, township, and section corners shown on this map are indefinite.

PIERCE COUNTY, WISCONSIN NO. 25

0 ½ Mile Scale 1:15840 0 3000 Feet



0 ½ Mile Scale 1:15840 0 3000 Feet



0 ½ Mile Scale 1:15840 0 3000 Feet

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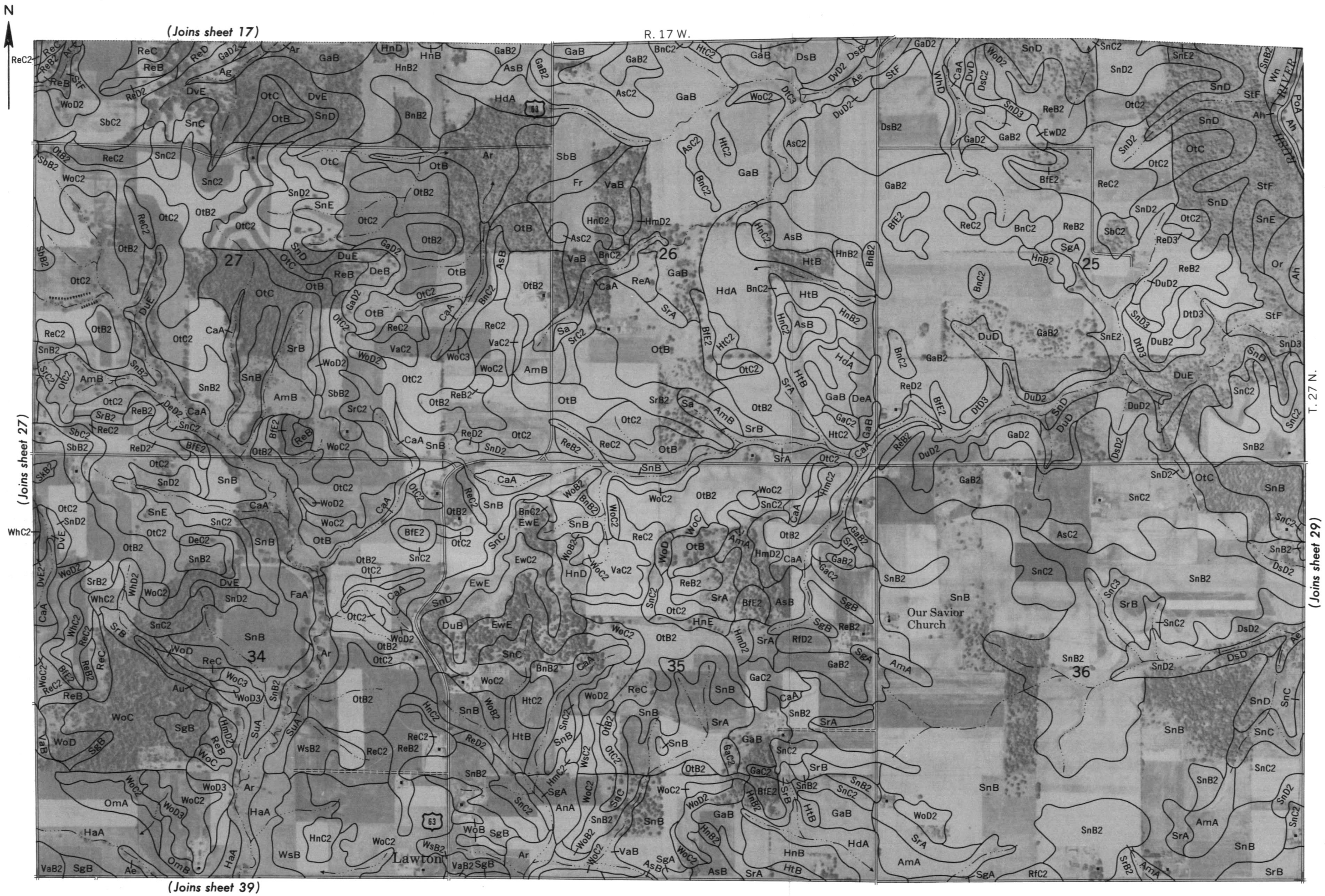
Range, township, and section corners shown on this map are indefinite.

PIERCE COUNTY, WISCONSIN NO. 27

28



0 ½ Mile Scale 1:15840 0 3000 Feet

PIERCE COUNTY, WISCONSIN NO. 28

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soil Survey Division, and Wisconsin Agricultural Experiment Station.

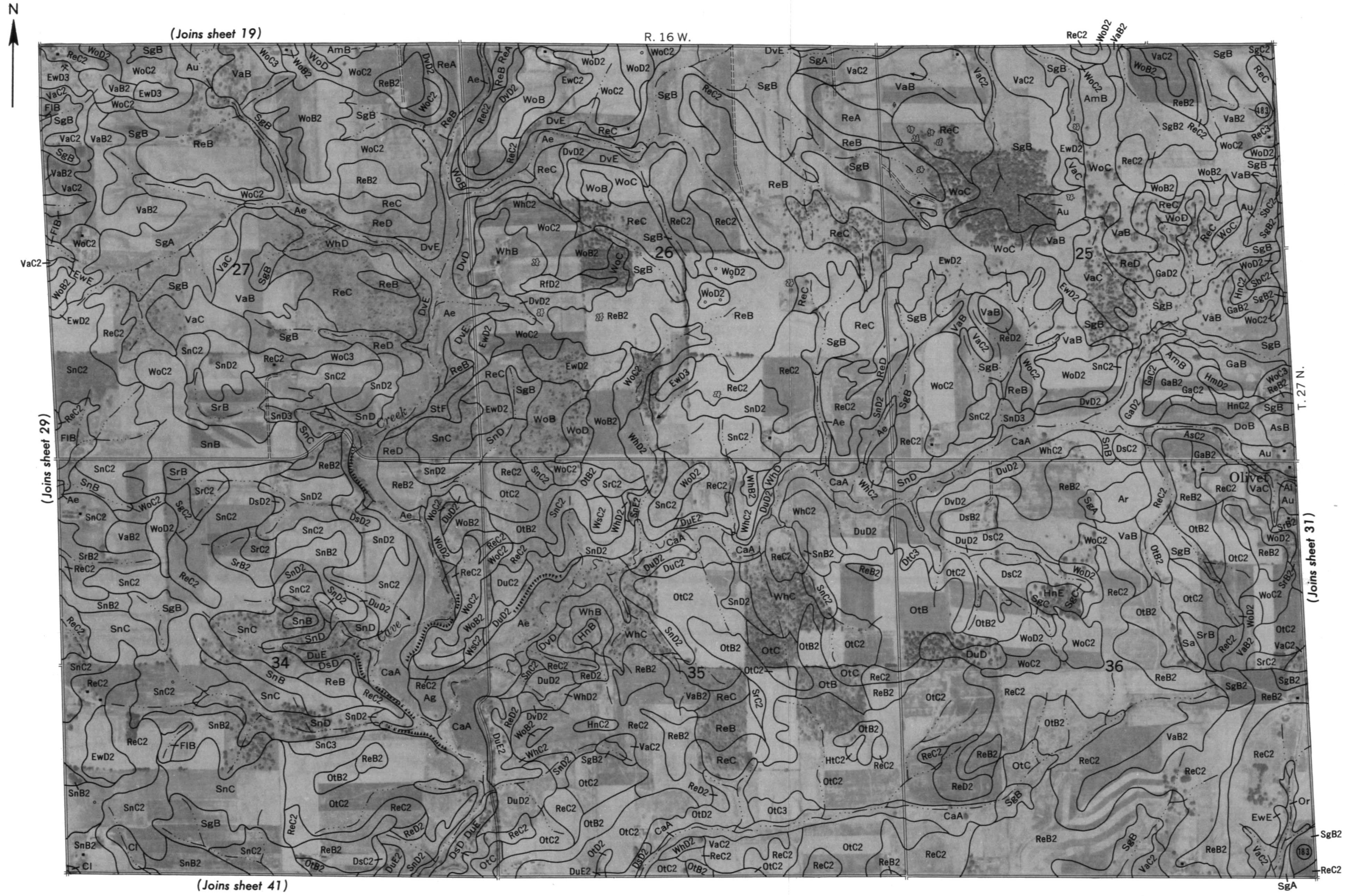
Range, township, and section corners shown on this map are indefinite.

PIERCE COUNTY, WISCONSIN NO. 29

N

0 ½ Mile Scale 1:15840 0 3000 Feet

(30)



0 ½ Mile Scale 1:15840 0 3000 Feet

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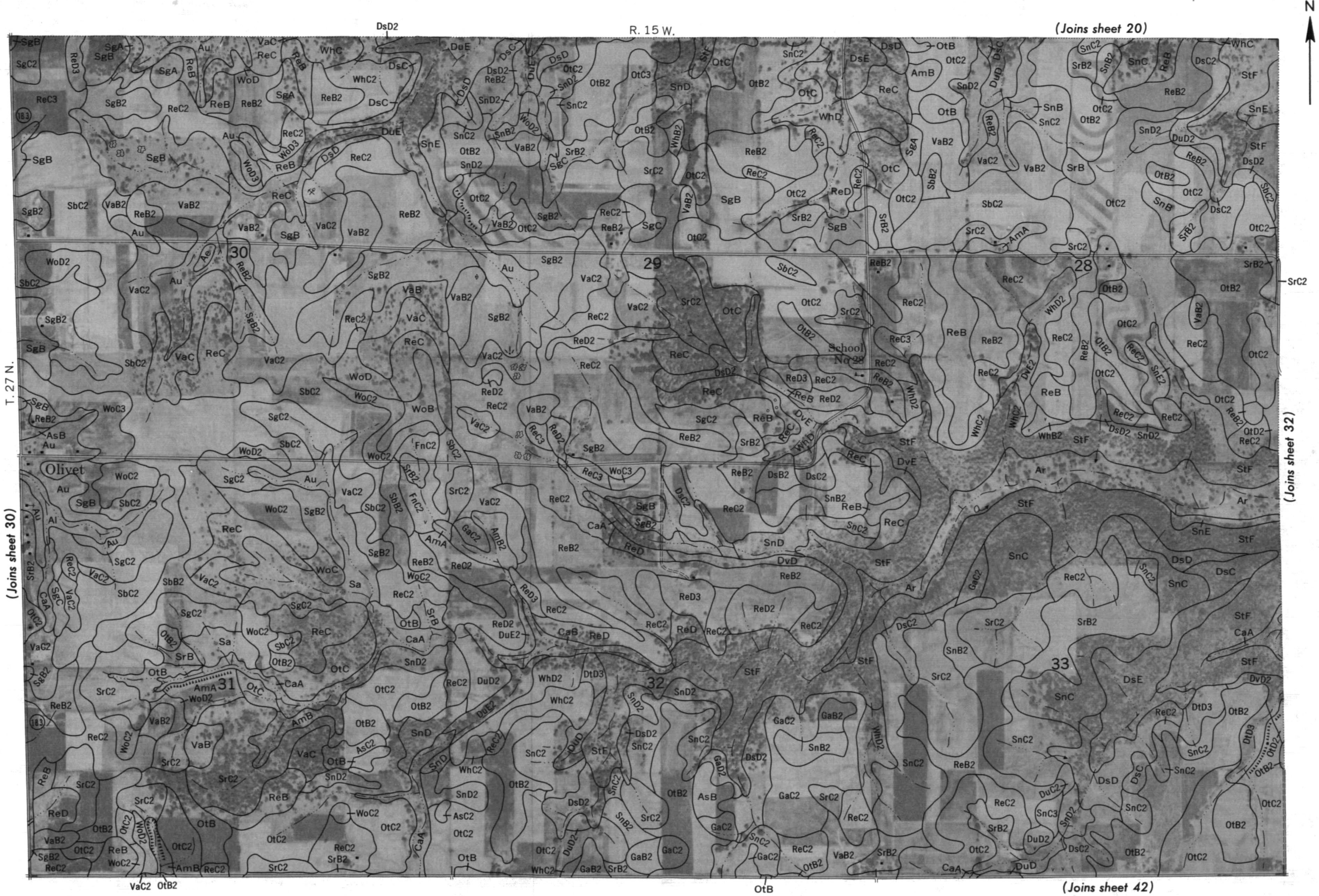
Range, township, and section corners shown on this map are indefinite.

PIERCE COUNTY, WISCONSIN NO. 31



0 ½ Mile Scale 1:15840 0 3000 Feet

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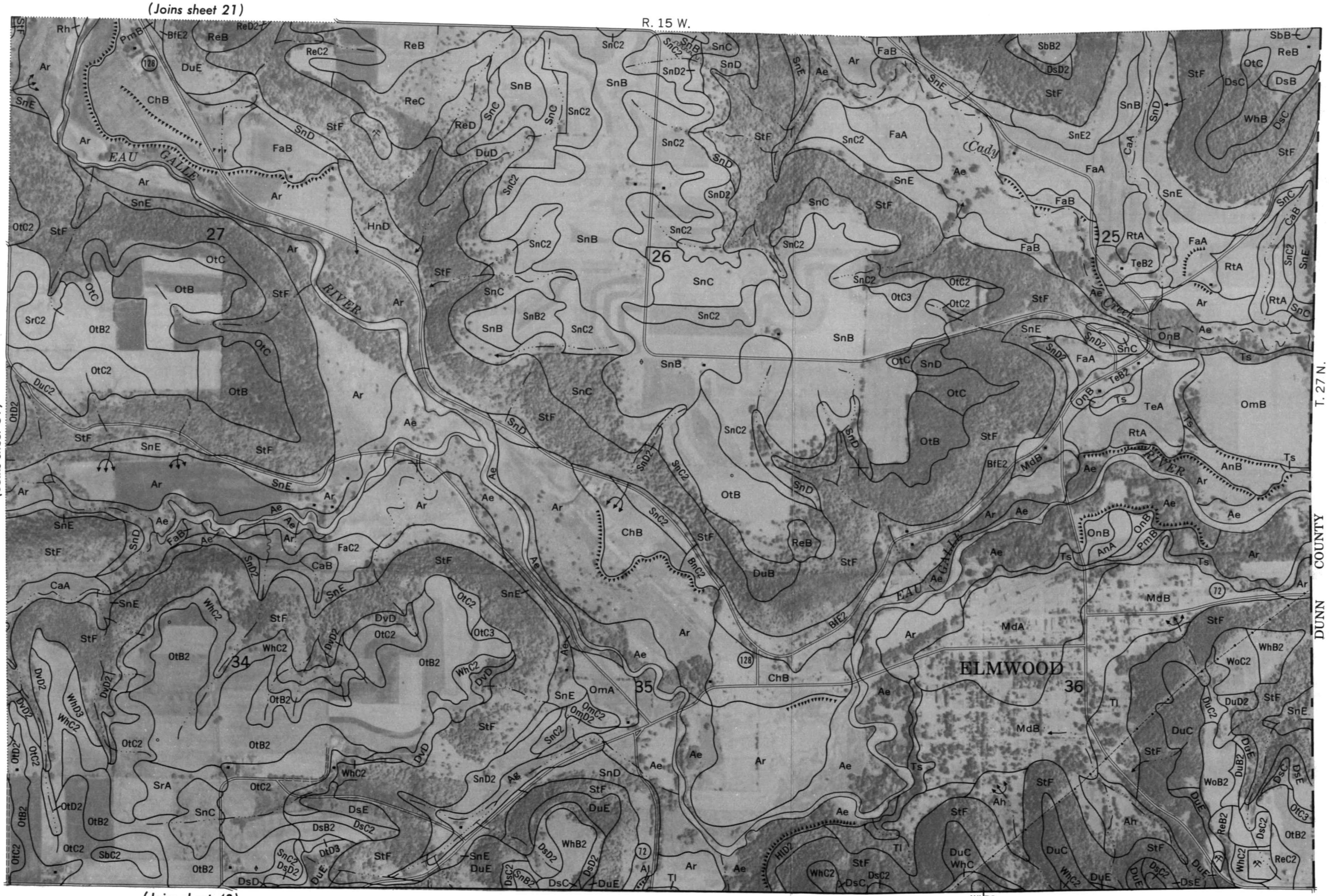

(Joins sheet 43)

(Joins sheet 31)

0 ½ Mile Scale 1:15840 0 3000 Feet

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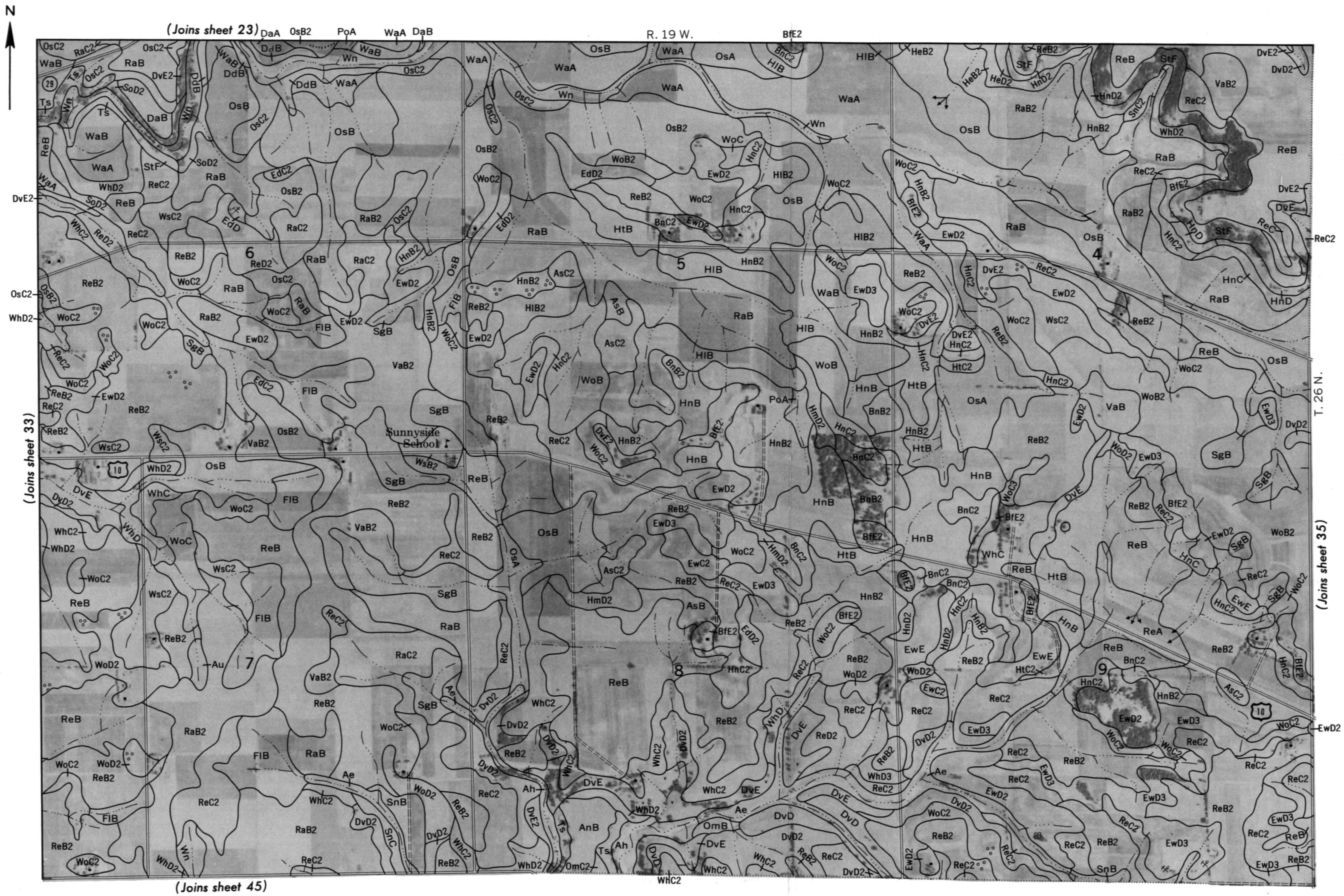
Range, township, and section corners shown on this map are indefinite.

PIERCE COUNTY, WISCONSIN NO. 33

0 ½ Mile Scale 1:15840 0 3000 Feet



0 ½ Mile Scale 1:15840 0 3000 Feet

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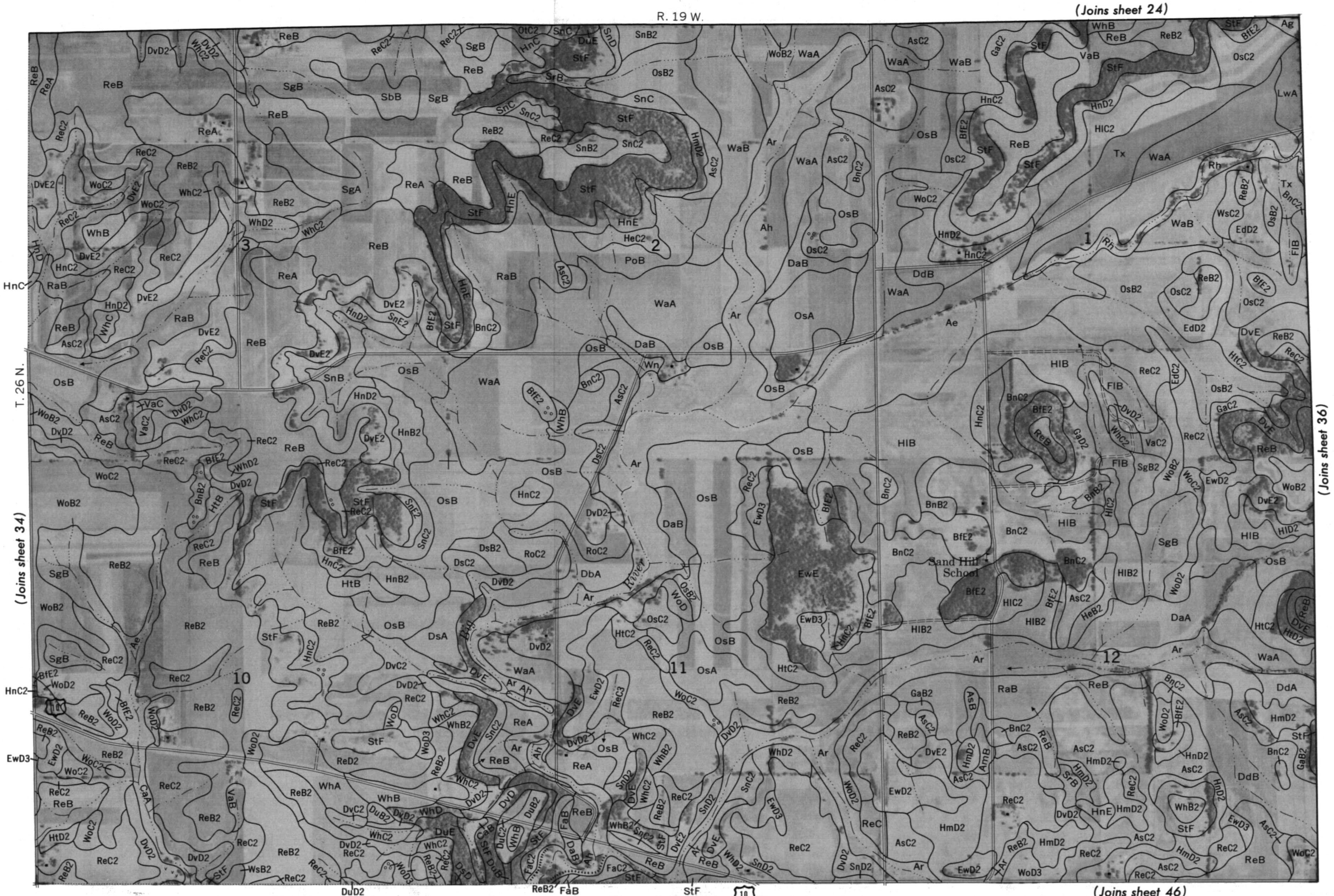
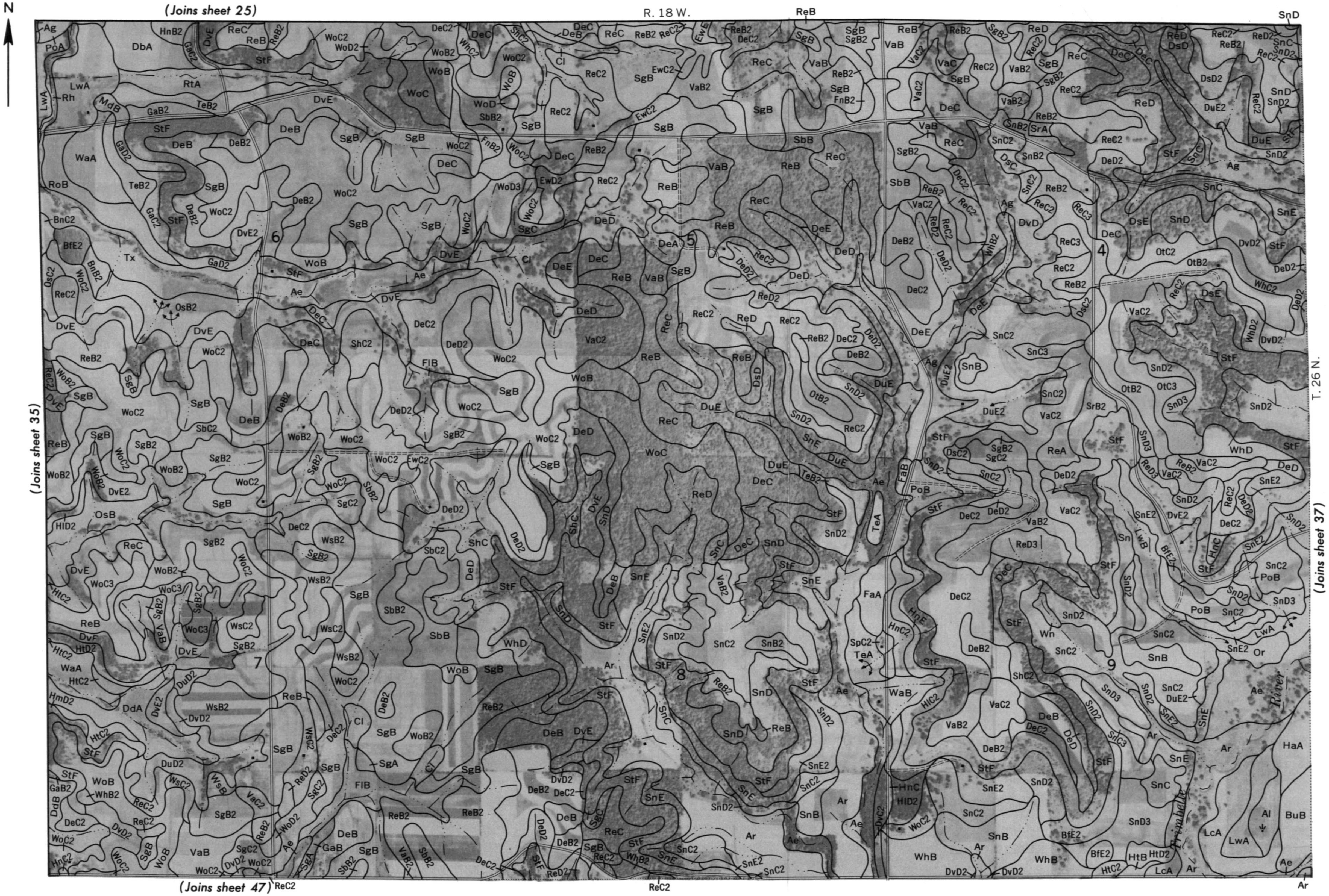
Range, township, and section corners shown on this map are indefinite.

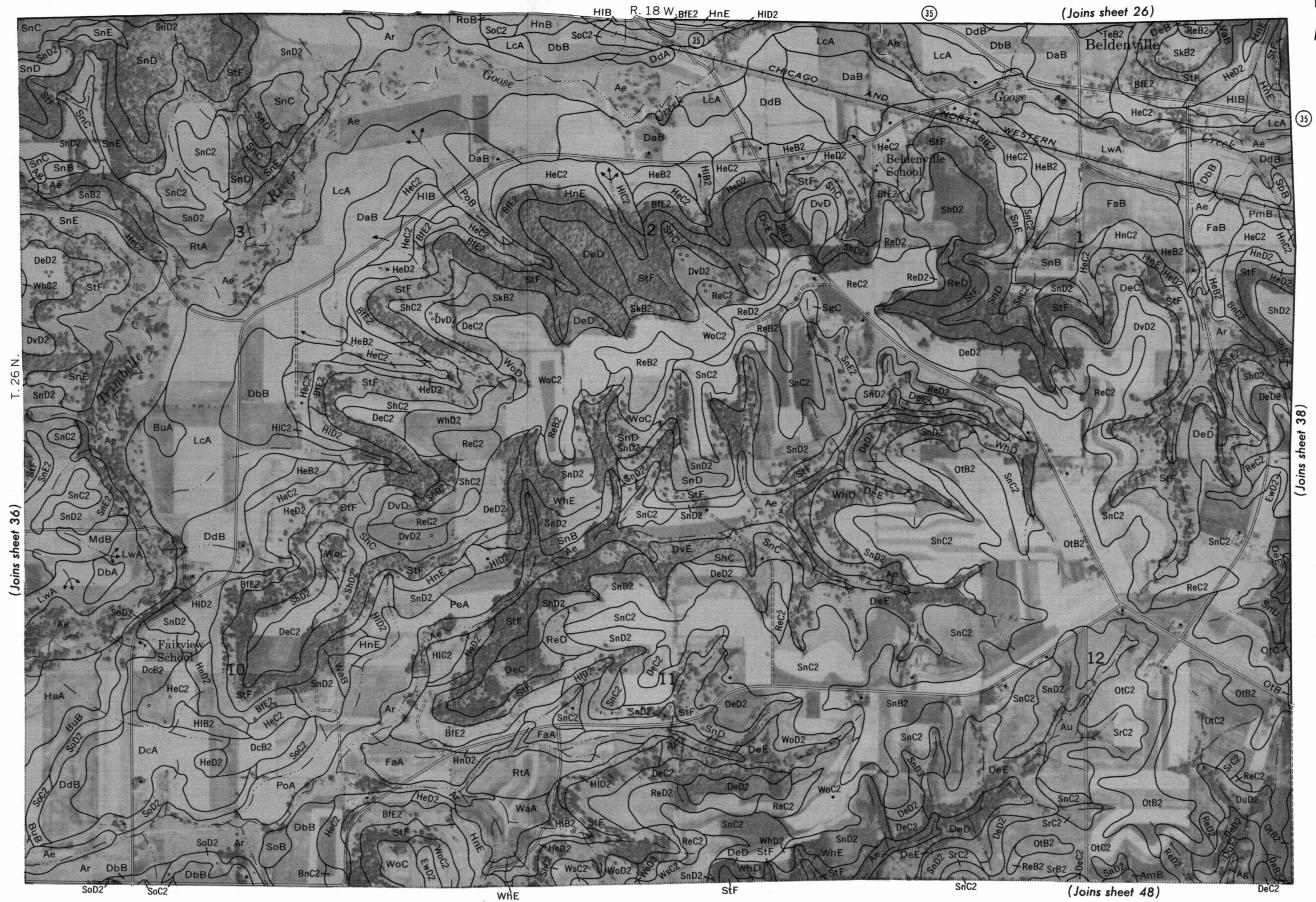
PIERCE COUNTY, WISCONSIN NO. 35



0 ½ Mile Scale 1:15840 0 3000 Feet



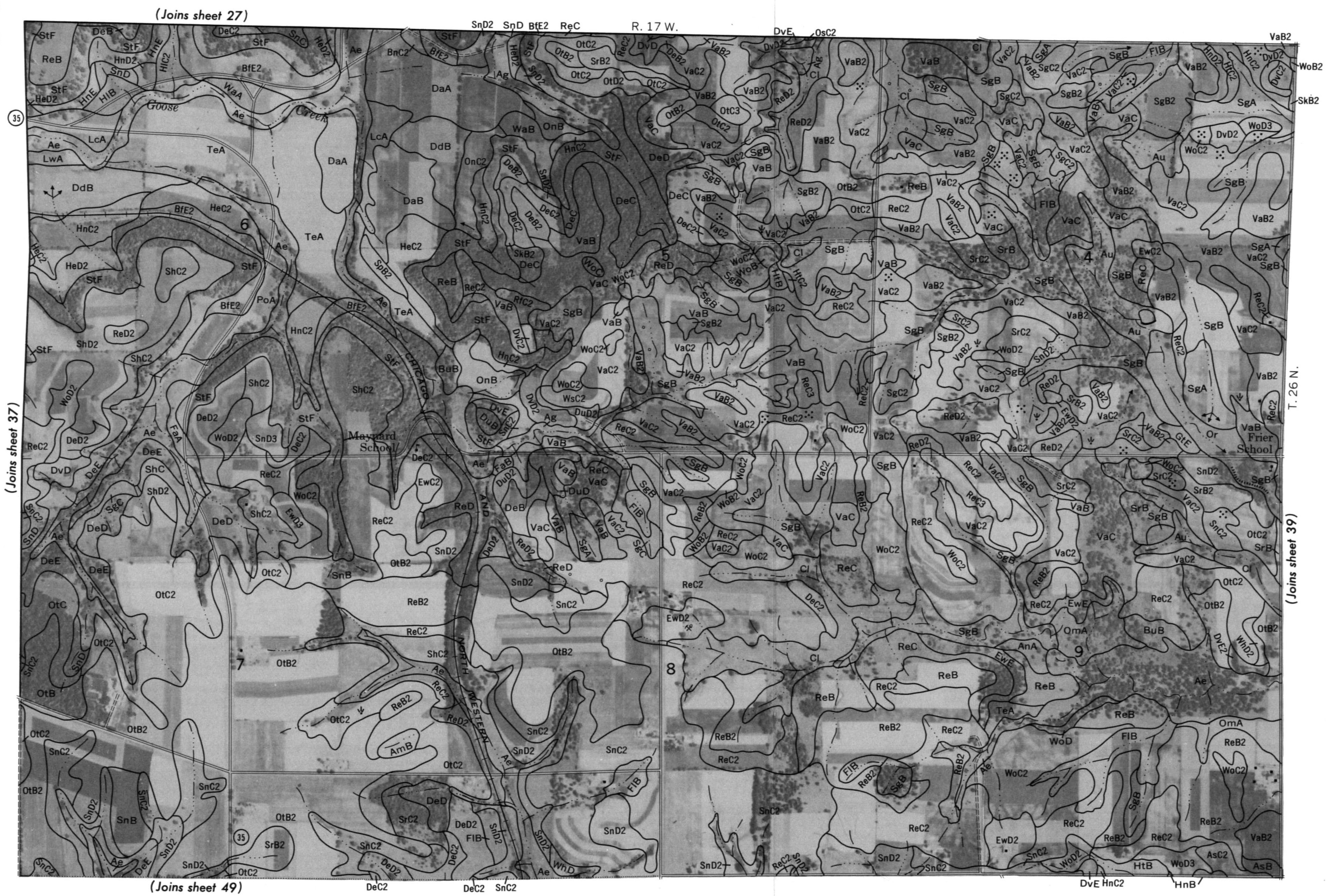
0 ½ Mile Scale 1:15840 0 3000 Feet



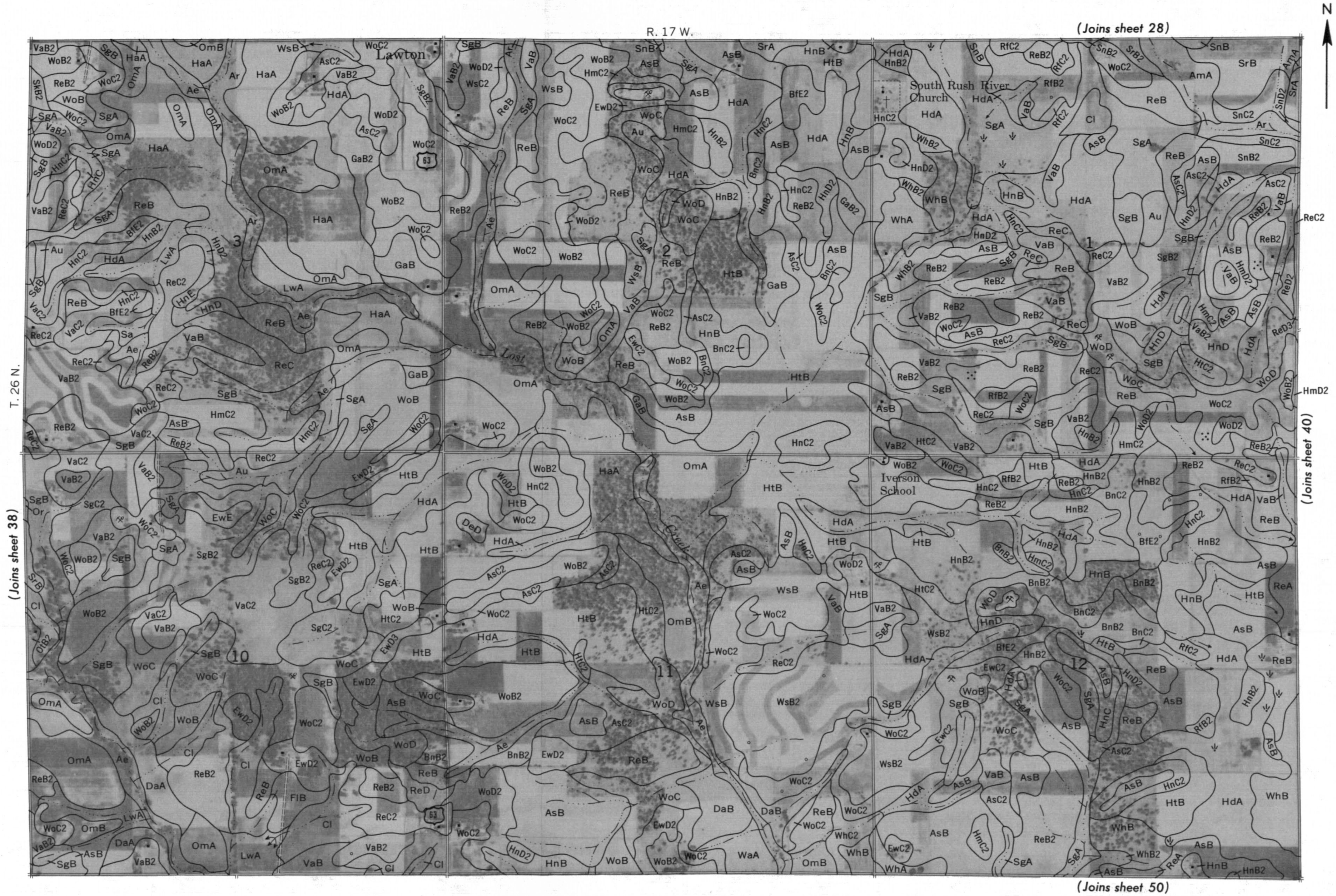
0 ½ Mile Scale 1:15840 0 3000 Feet

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soil Survey Division, and Wisconsin Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.



0 ½ Mile Scale 1:15840 0 3000 Feet



0 ½ Mile Scale 1:15840 0 3000 Feet

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soil Survey Division, and Wisconsin Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

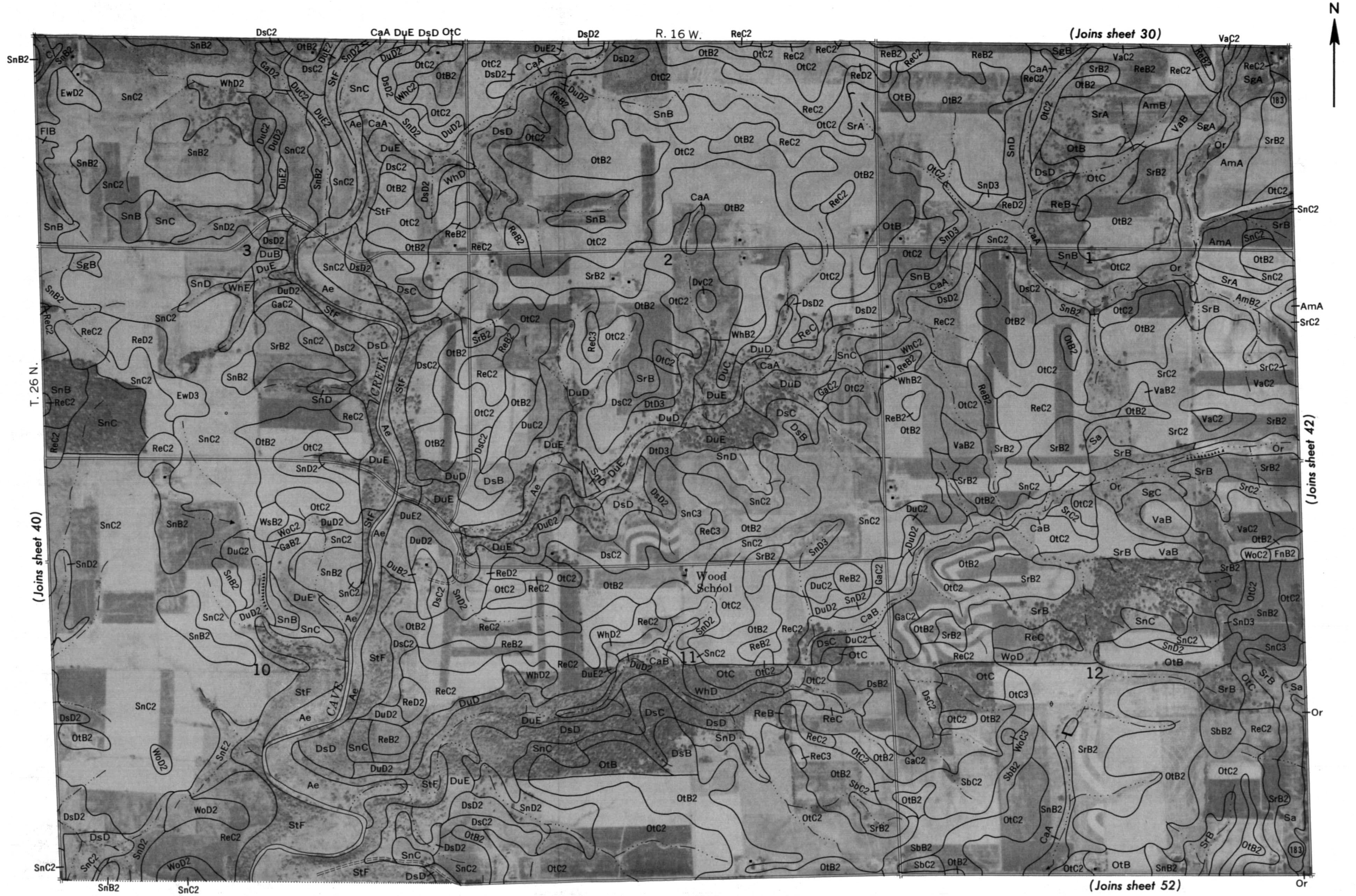
PIERCE COUNTY, WISCONSIN NO. 39

0 ½ Mile Scale 1:15840 0 3000 Feet

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soil Survey Division, and Wisconsin Agricultural Experiment Station.

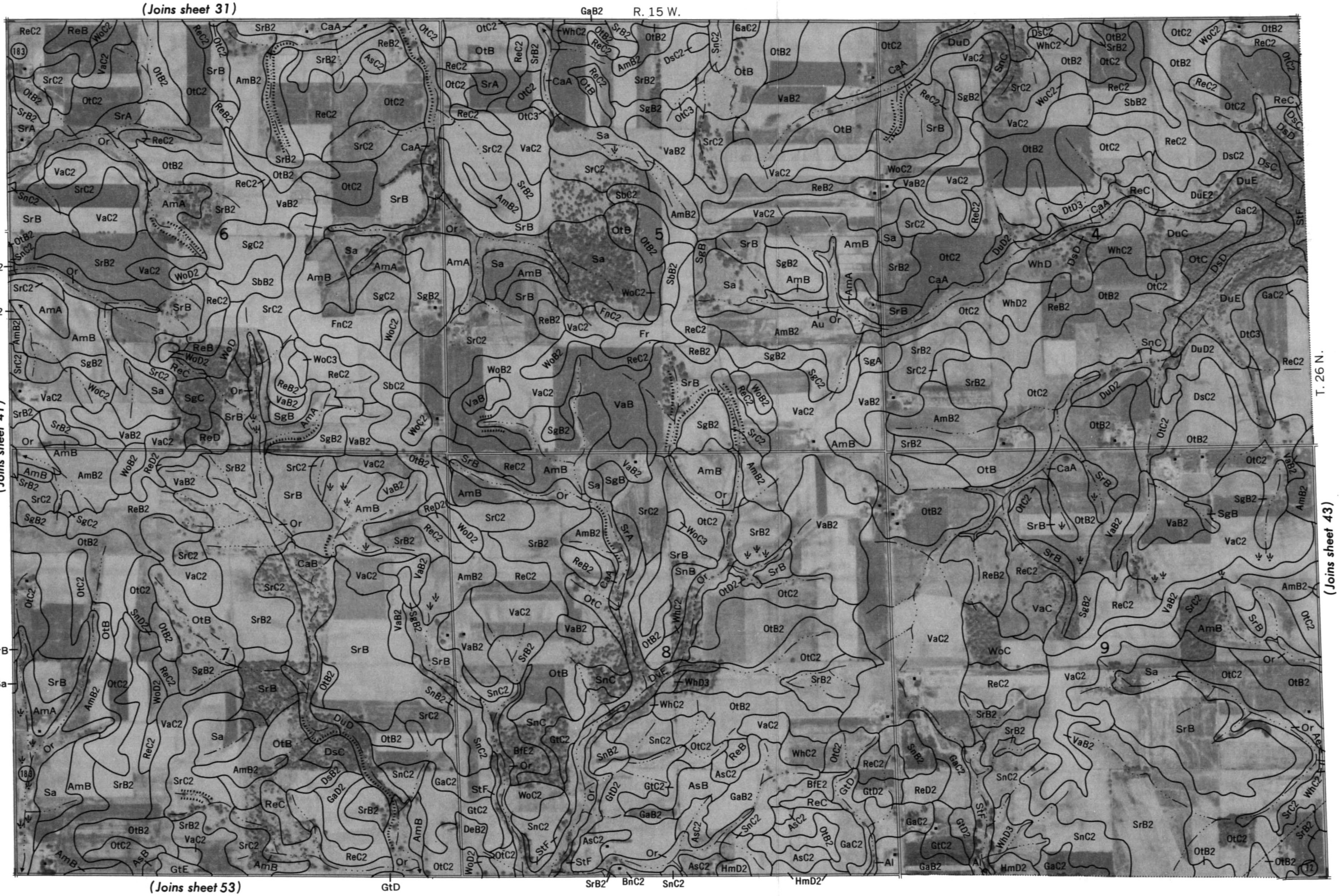
Range, township, and section corners shown on this map are indefinite.

PIERCE COUNTY, WISCONSIN NO. 41



0 ½ Mile Scale 1:15840 0 3000 Feet

N



0 ½ Mile Scale 1:15840 0 3000 Feet

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soil Survey Division, and Wisconsin Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

PIERCE COUNTY, WISCONSIN NO. 43

0 ½ Mile Scale 1:15840 0 3000 Feet

N

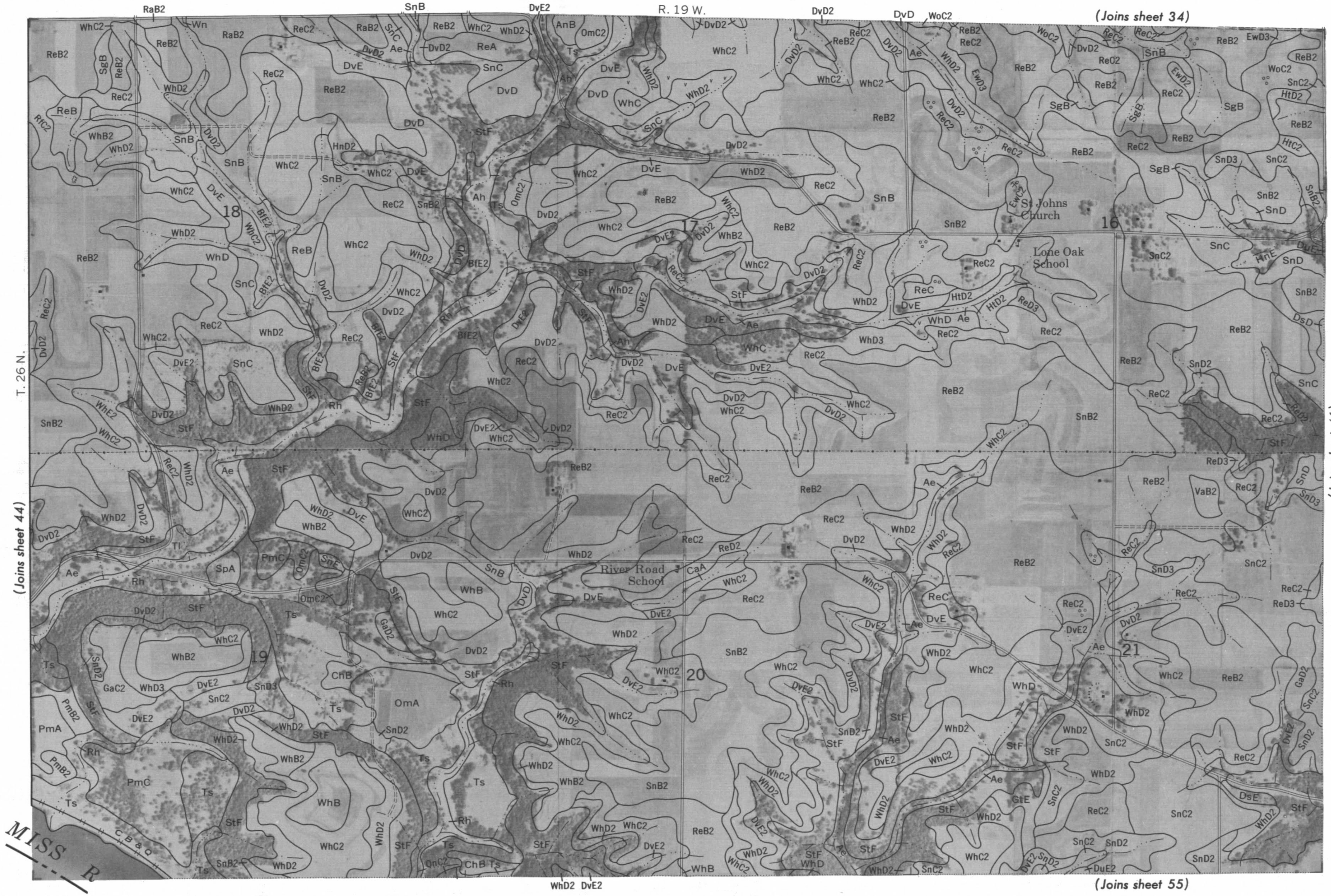
0 ½ Mile Scale 1:15840 0 3000 Feet

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soil Survey Division, and Wisconsin Agricultural Experiment Station.

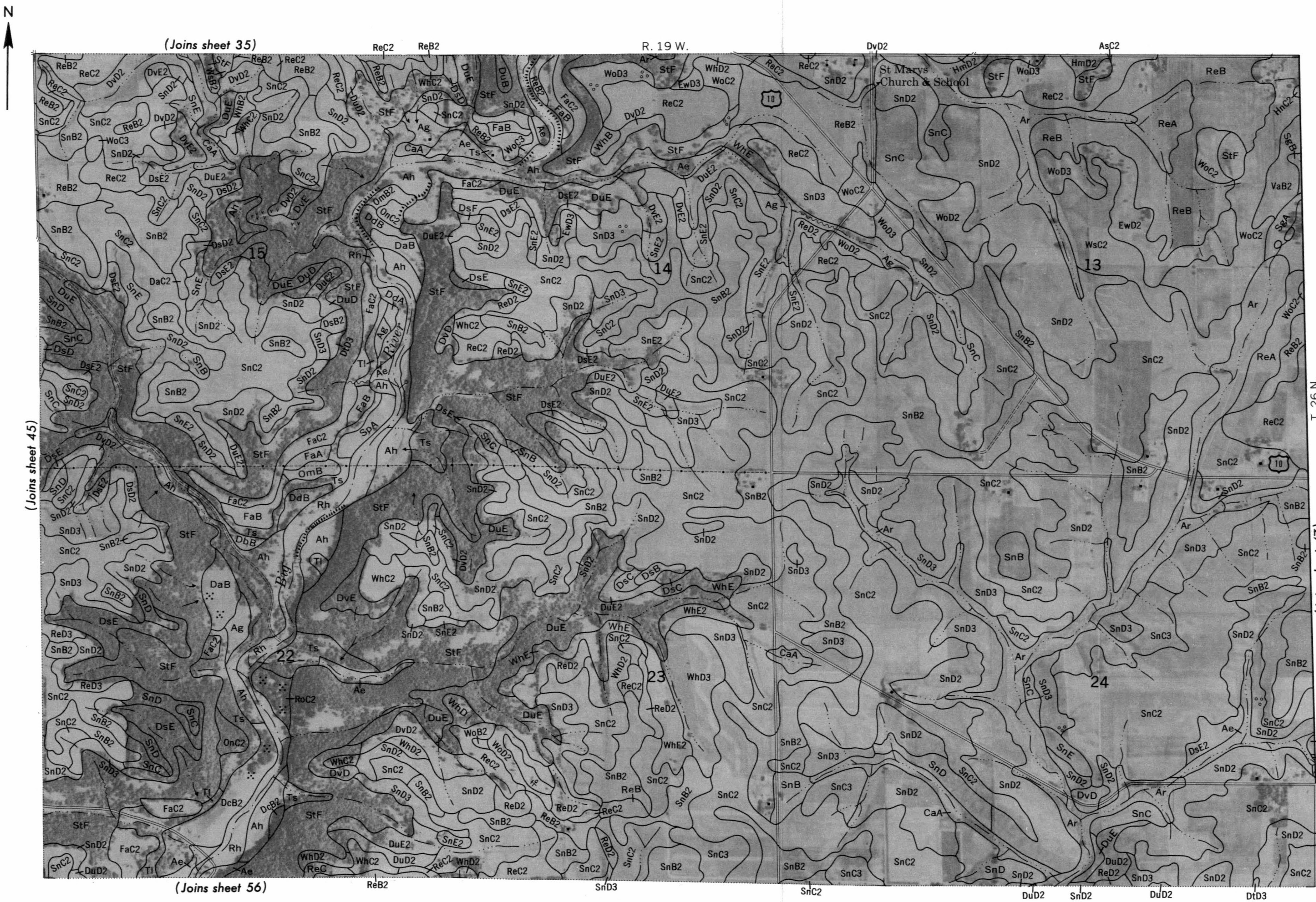
Range, township, and section corners shown on this map are indefinite.

PIERCE COUNTY, WISCONSIN NO. 45

N



0 ½ Mile Scale 1:15840 0 3000 Feet



0 ½ Mile Scale 1:15840 0 3000 Feet

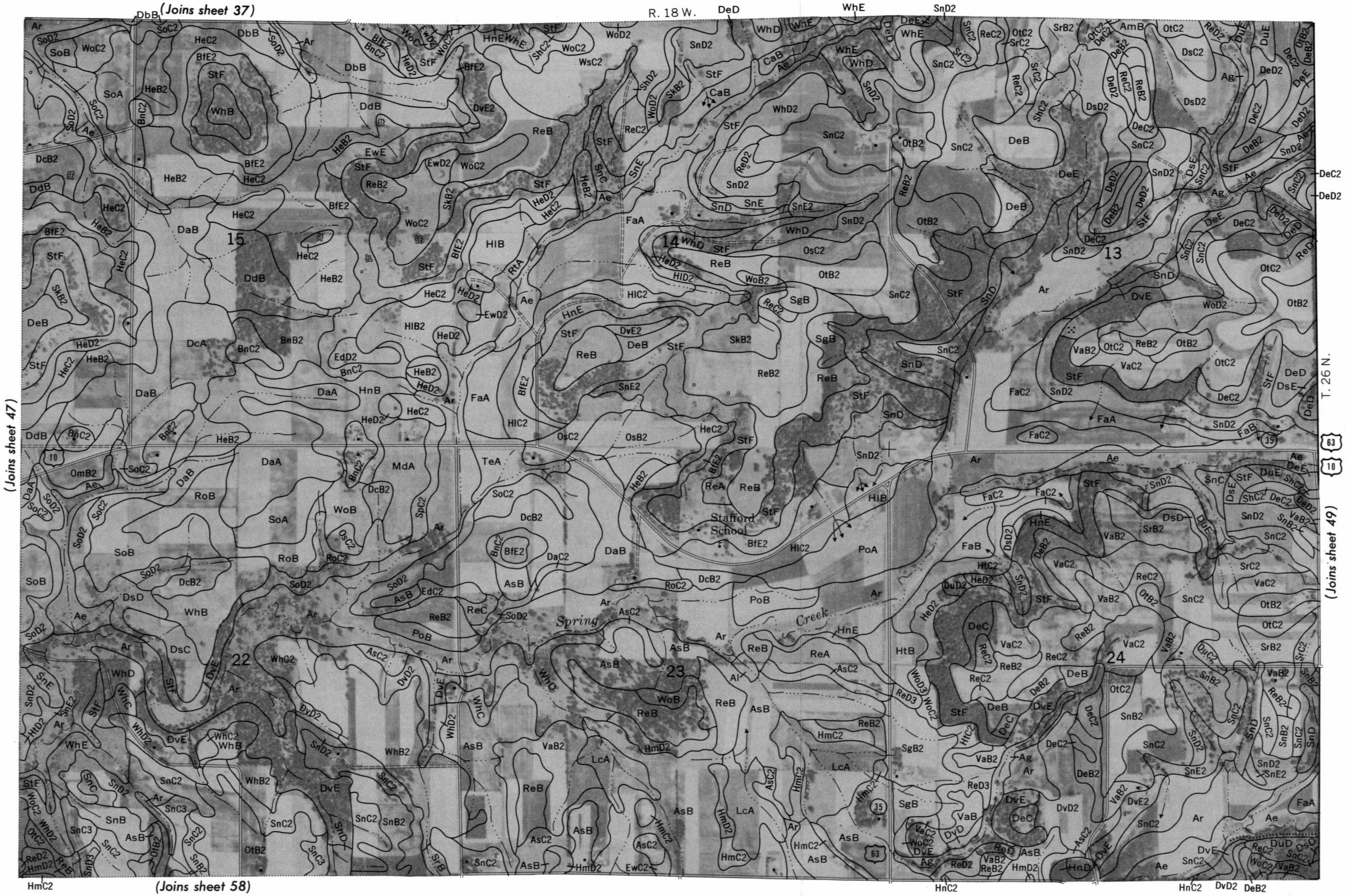
PIERCE COUNTY, WISCONSIN NO. 46

0 ½ Mile Scale 1:15840 0 3000 Feet

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soil Survey Division, and Wisconsin Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

N



0 ½ Mile

Scale 1:15840

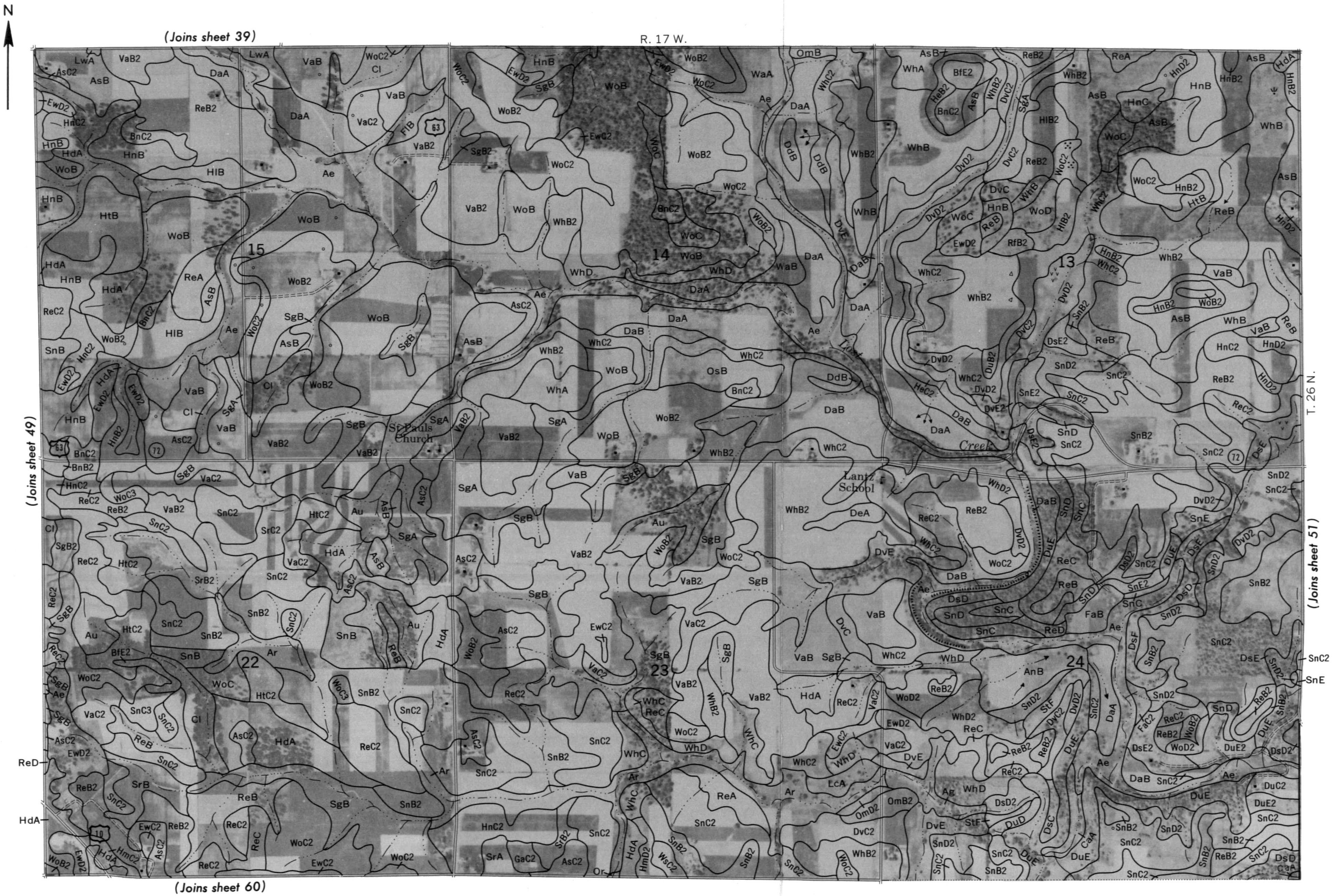
0 3000 Feet

0 ½ Mile Scale 1:15840 0 3000 Feet

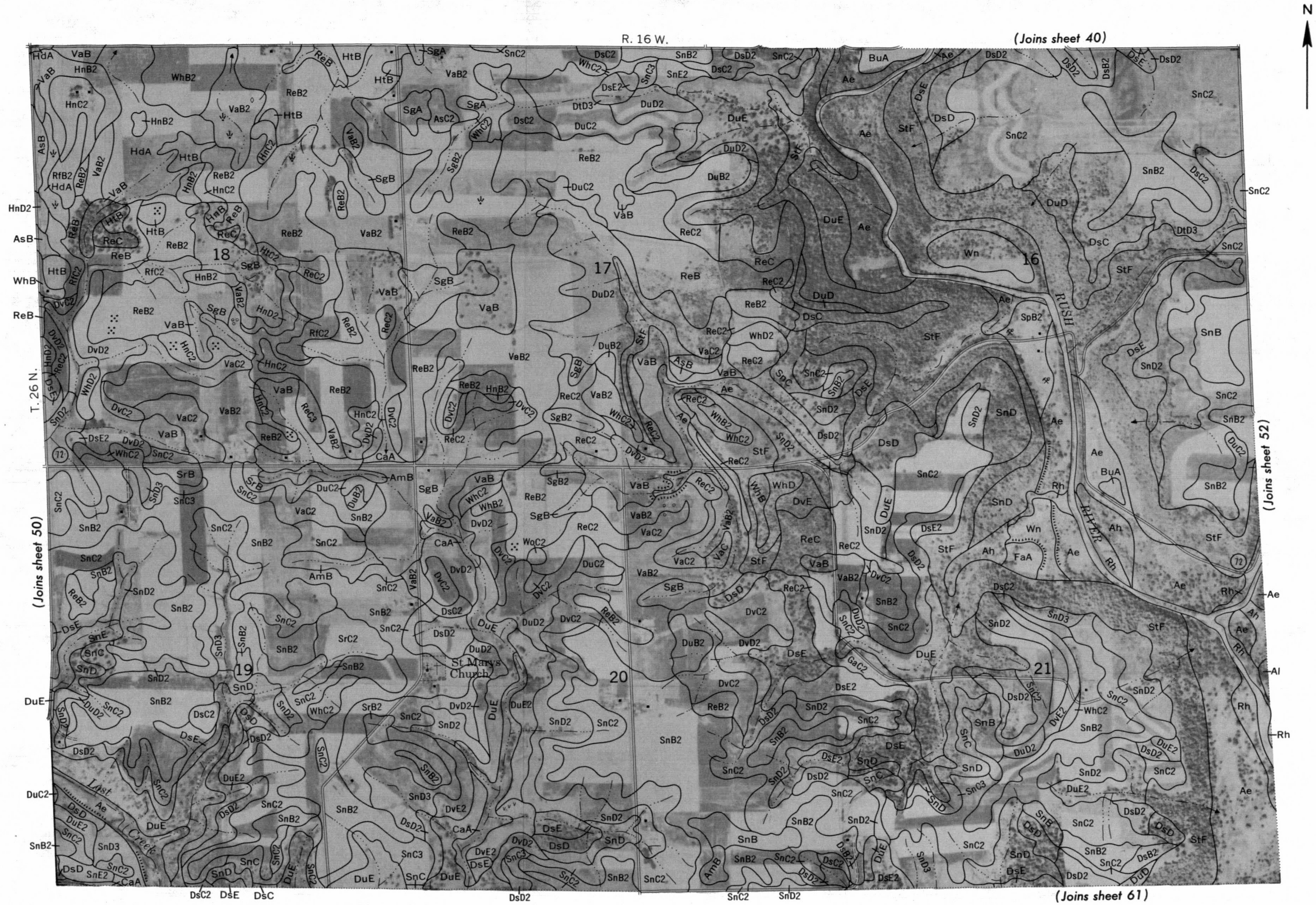
This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soil Survey Division, and Wisconsin Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

PIERCE COUNTY, WISCONSIN NO. 49



0 ½ Mile Scale 1:15840 0 3000 Feet

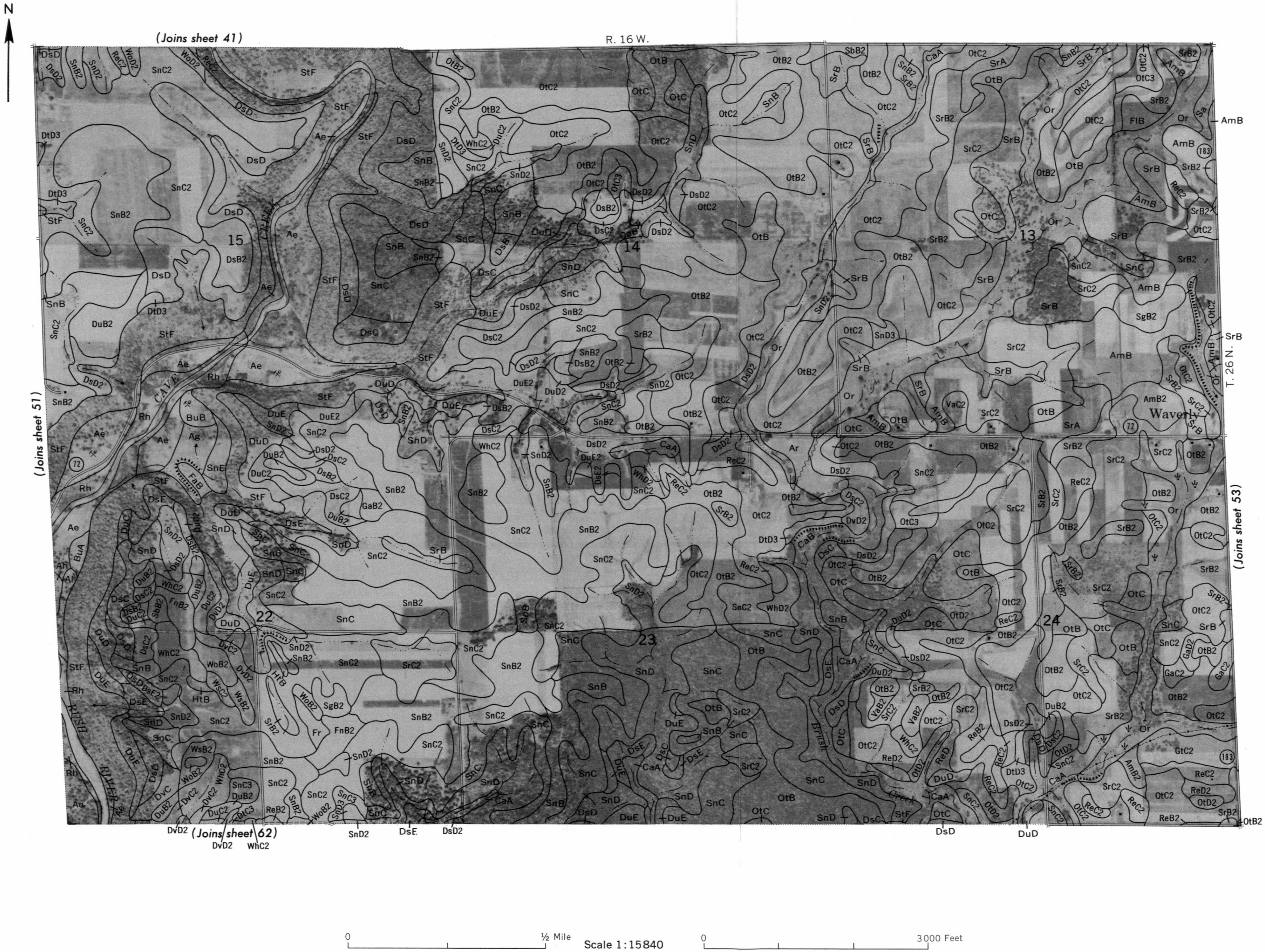


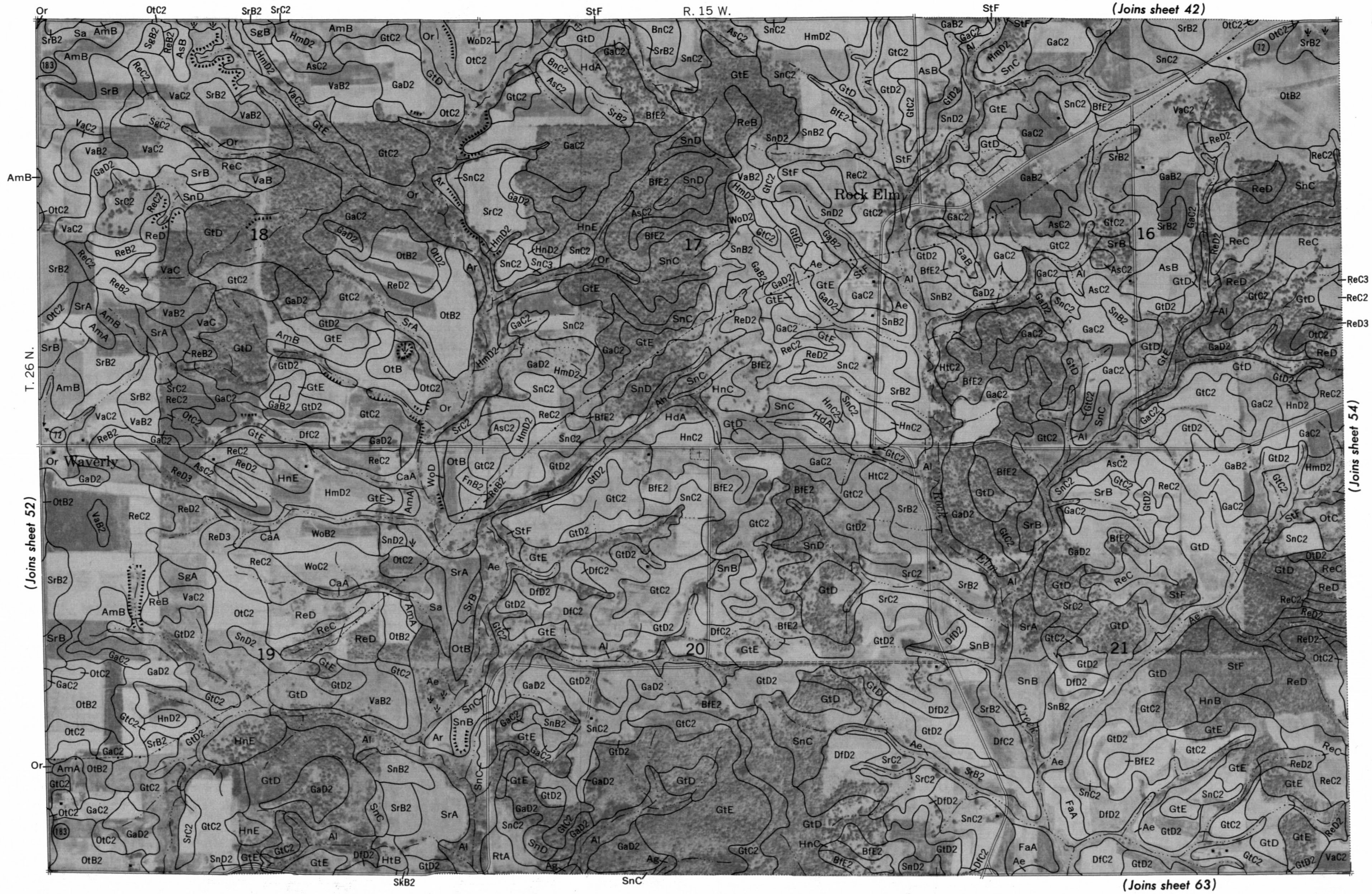
0 ½ Mile Scale 1:15840 0 3000 Feet

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soil Survey Division, and Wisconsin Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

PIERCE COUNTY, WISCONSIN NO. 51


N
(Joins sheet 41)
R. 16 W.
(Joins sheet 51)
(Joins sheet 53)
(Joins sheet 62)
T. 26 N.
Waverly
15
14
13
22
23
24
0
½ Mile
Scale 1:15840
0
3000 Feet



0 ½ Mile Scale 1:15840 0 3000 Feet

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soil Survey Division, and Wisconsin Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

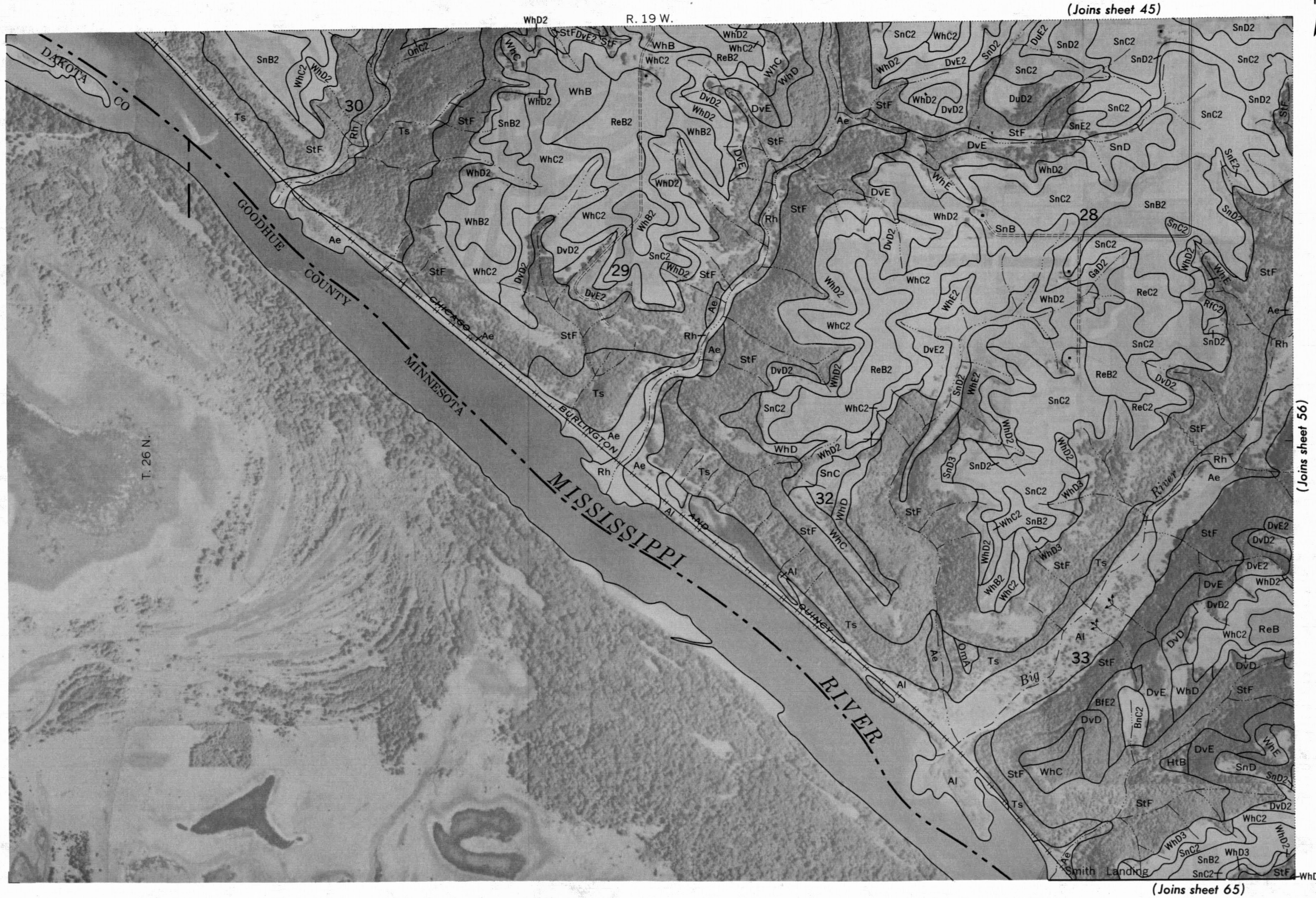
N

0 ½ Mile Scale 1:15840 0 3000 Feet

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soil Survey Division, and Wisconsin Agricultural Experiment Station.

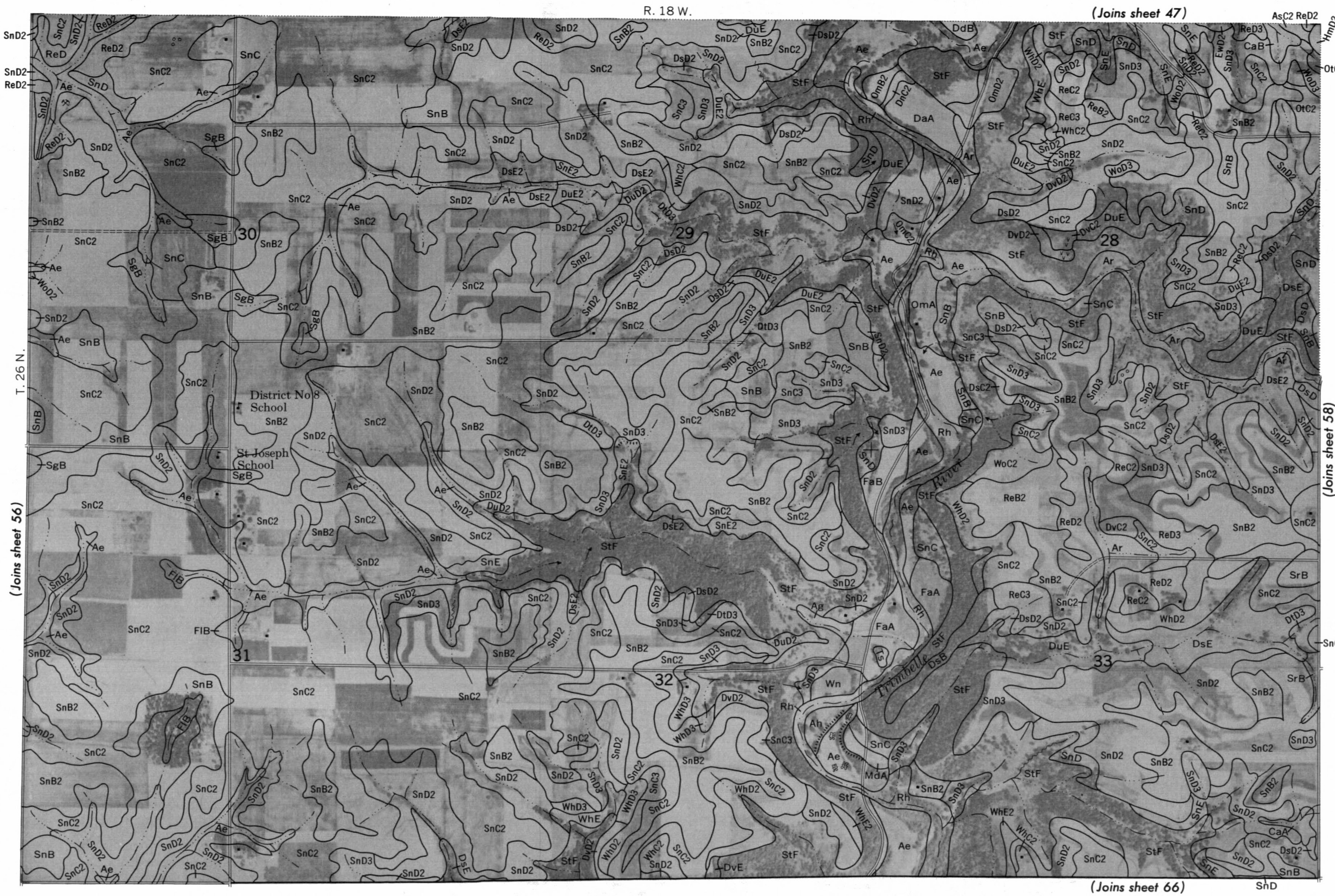
Range, township, and section corners shown on this map are indefinite.

PIERCE COUNTY, WISCONSIN NO. 55



0 ½ Mile Scale 1:15840 0 3000 Feet

0 ½ Mile Scale 1:15840 0 3000 Feet



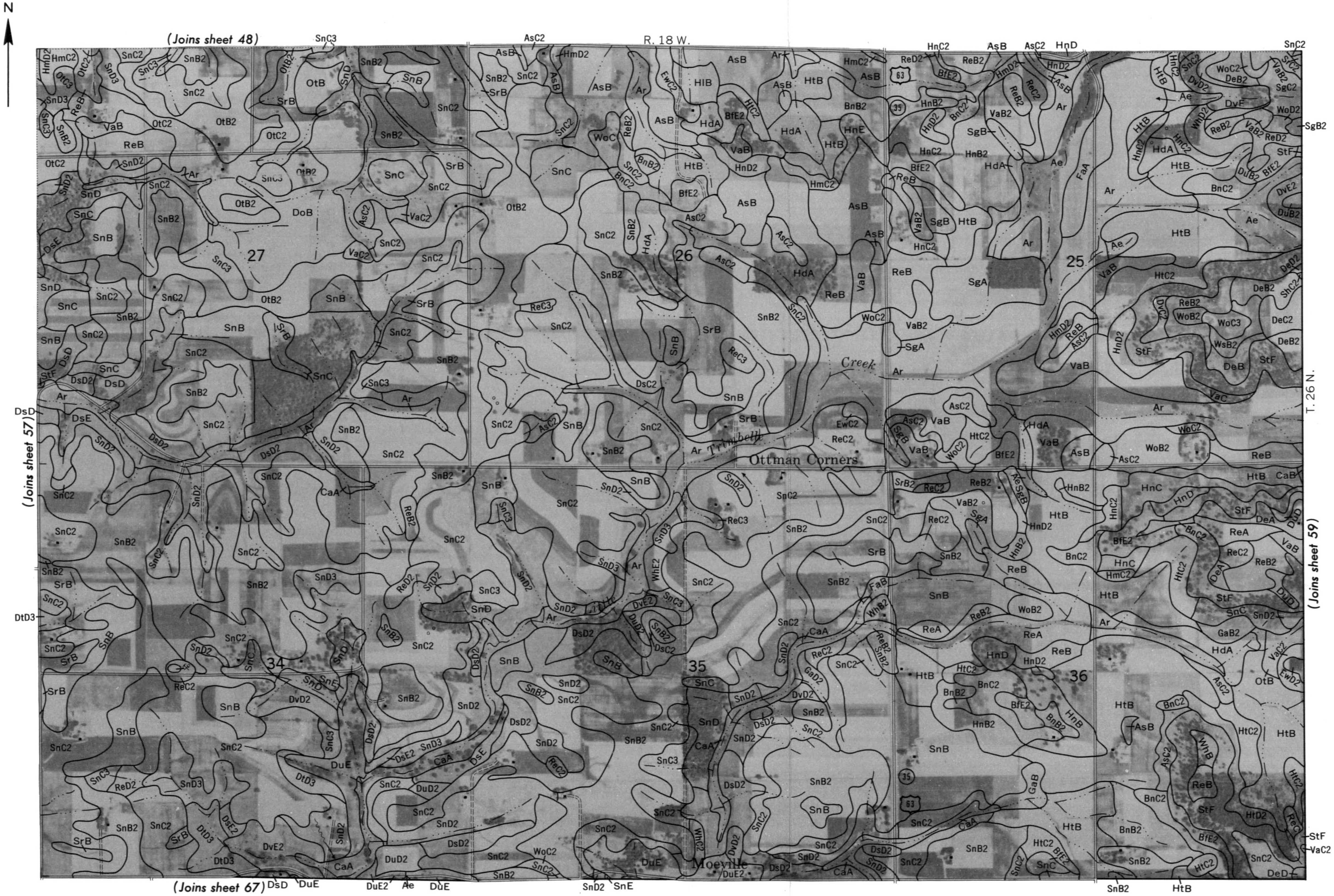
0 ½ Mile Scale 1:15840 0 3000 Feet

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soil Survey Division, and Wisconsin Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

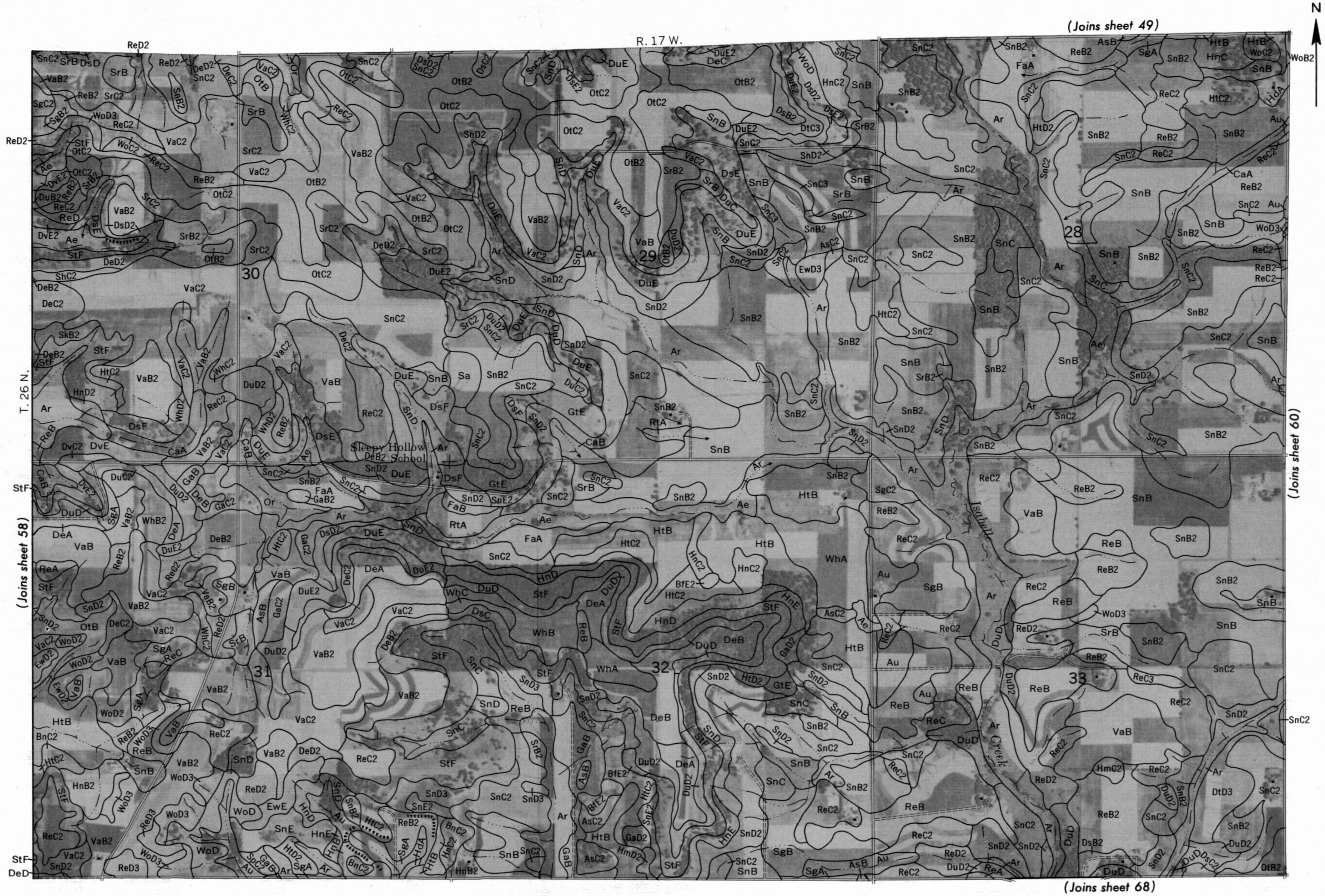
PIERCE COUNTY, WISCONSIN NO. 57

PIERCE COUNTY, WISCONSIN — SHEET NUMBER 58



0 ½ Mile Scale 1:15840 0 3000 Feet

59



This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soil Survey Division, and Wisconsin Agricultural Experiment Station.

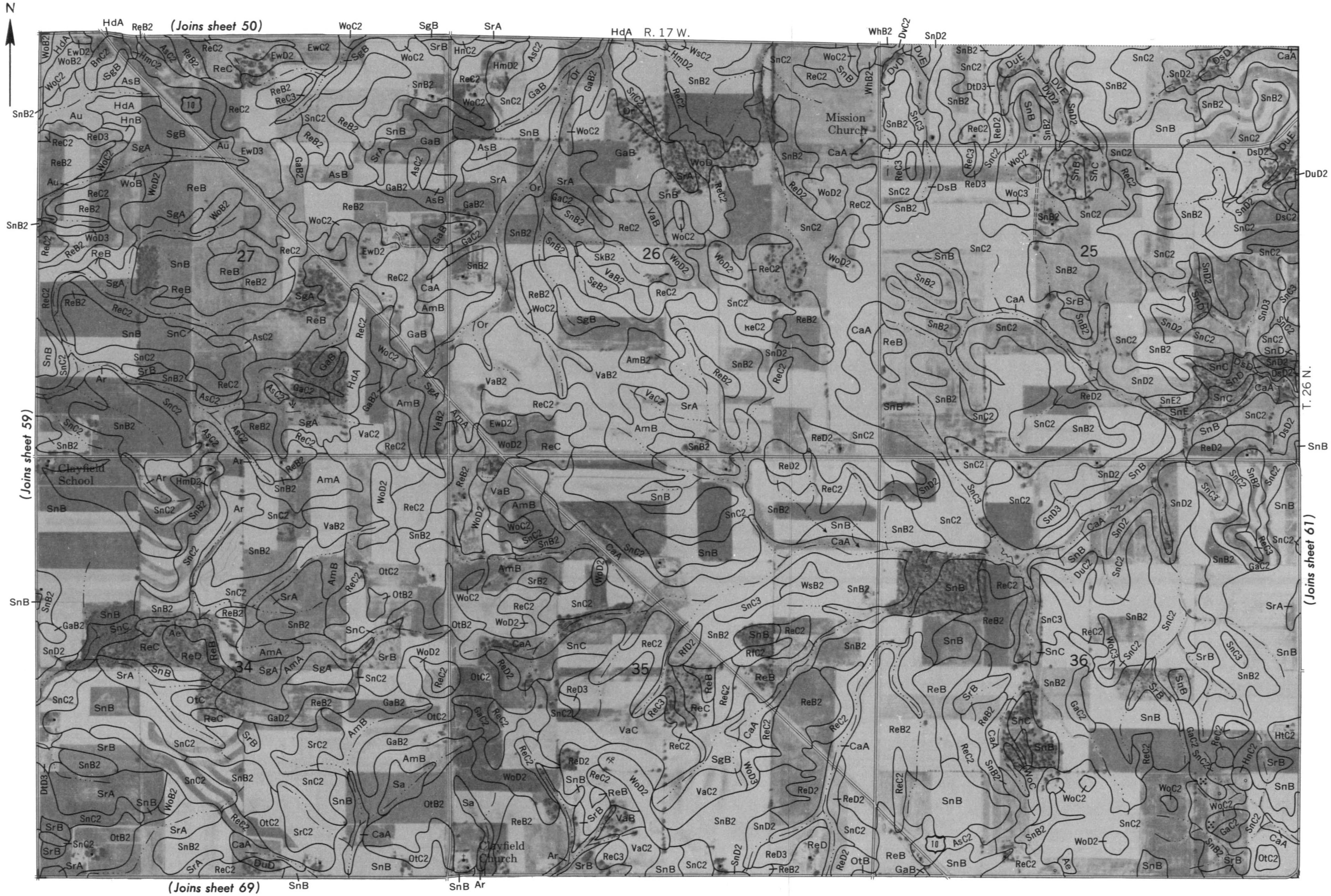
Range, township, and section corners shown on this map are indefinite.

PIERCE COUNTY, WISCONSIN NO. 59

0 ½ Mile

Scale 1:15840

0 3000 Feet



0 ½ Mile Scale 1:15840 0 3000 Feet

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soil Survey Division, and Wisconsin Agricultural Experiment Station.

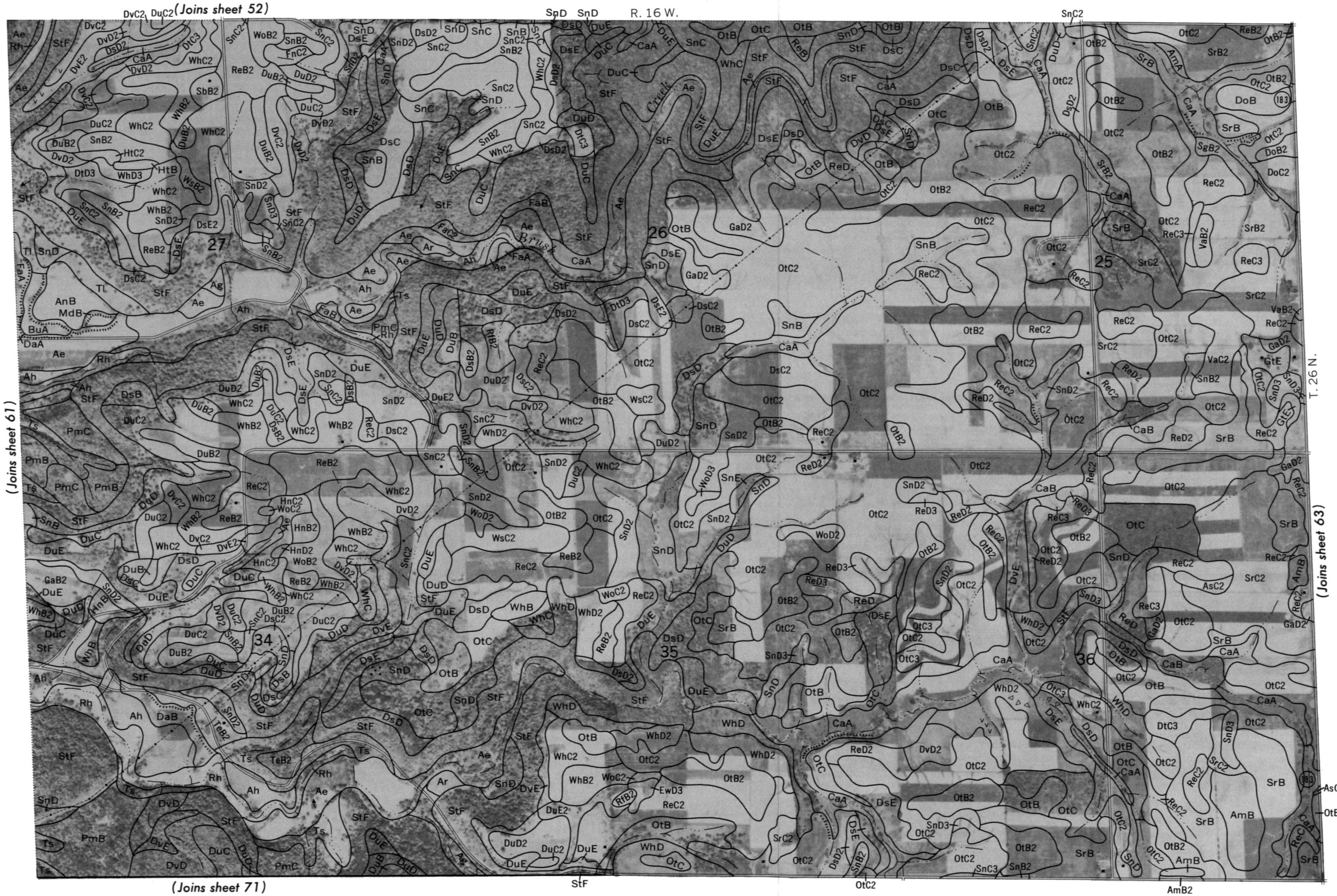
Range, township, and section corners shown on this map are indefinite.

PIERCE COUNTY, WISCONSIN NO. 61

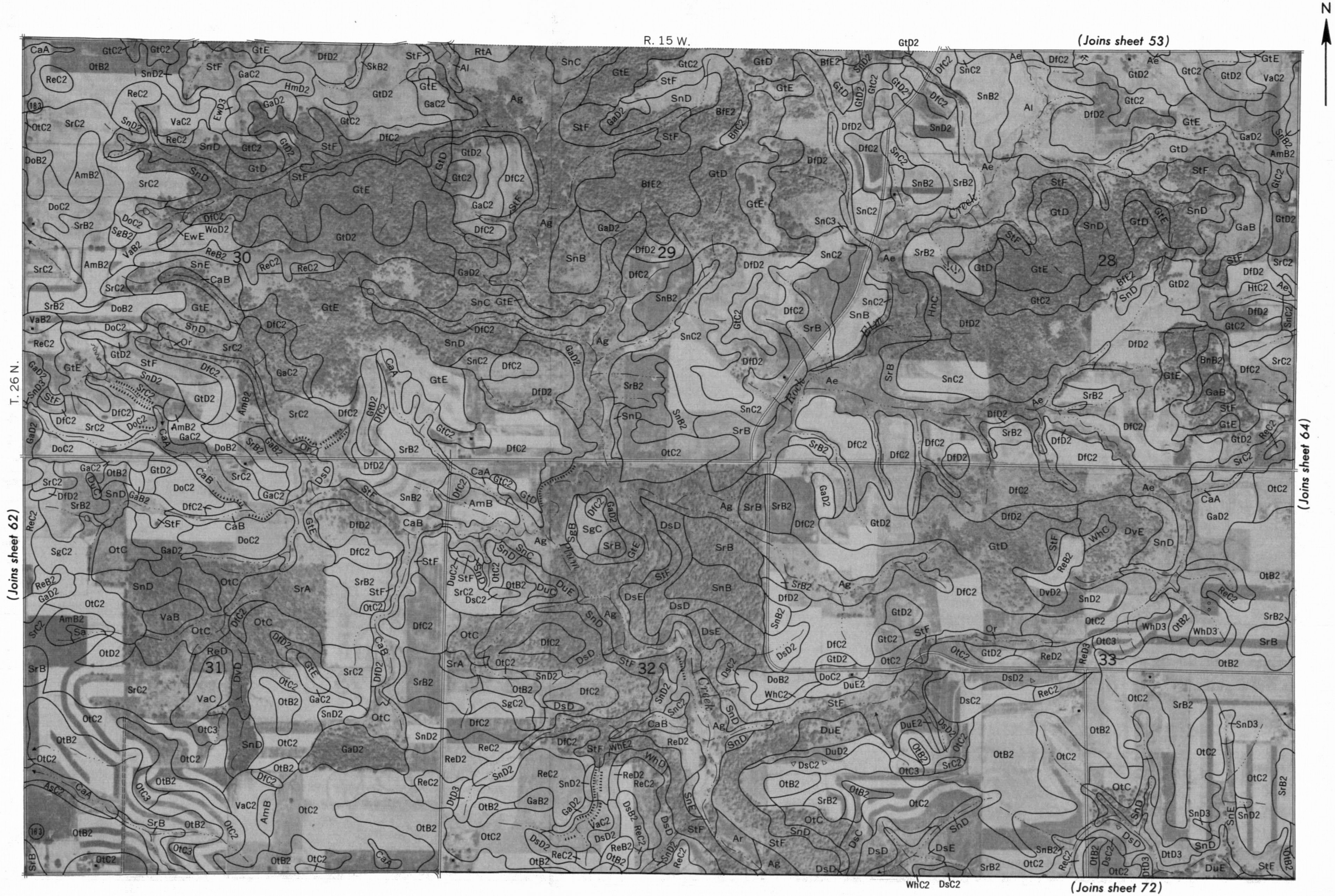
0 ½ Mile Scale 1:15840 0 3000 Feet

PIERCE COUNTY, WISCONSIN — SHEET NUMBER 62

N



0 ½ Mile Scale 1:15840 0 3000 Feet

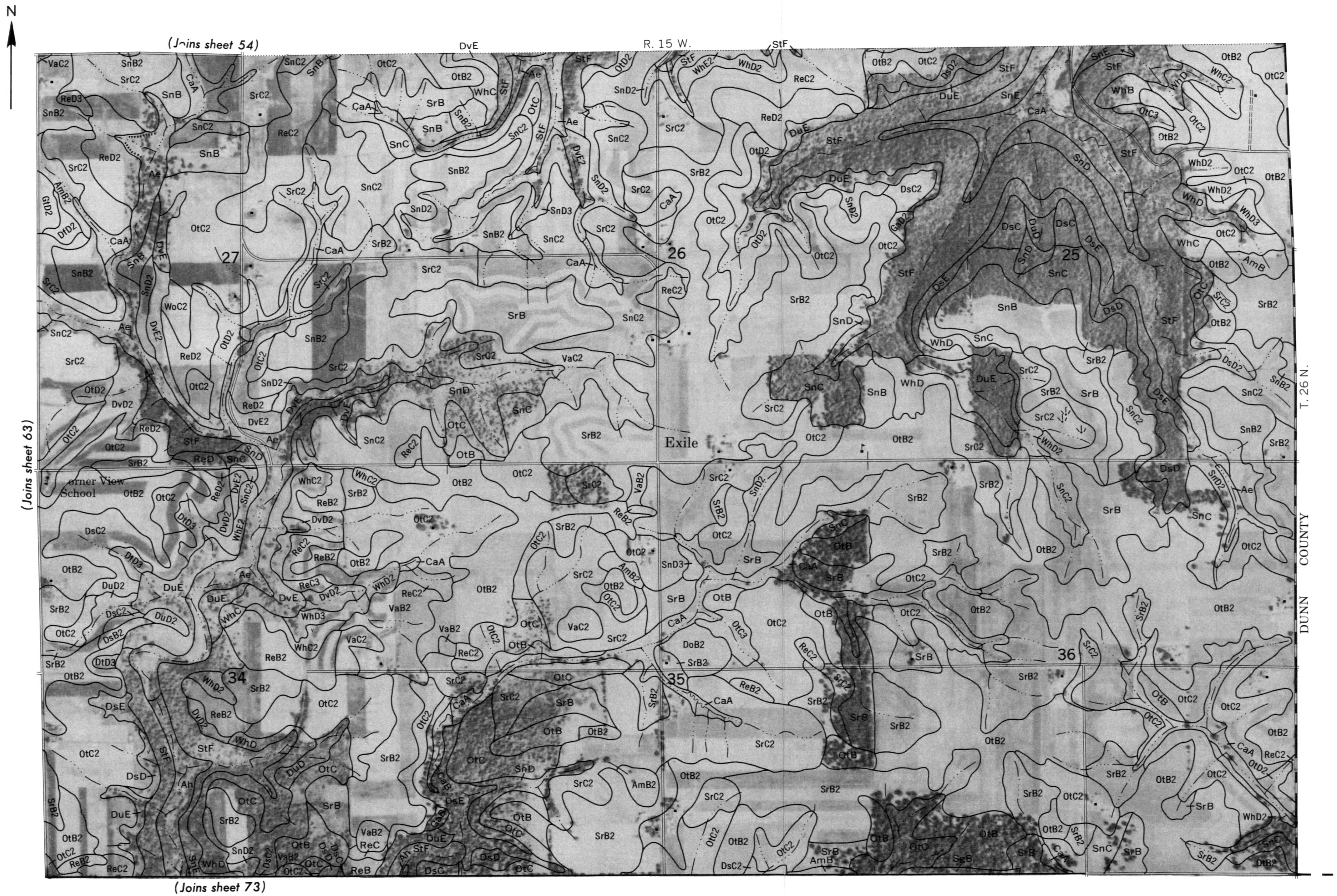


0 ½ Mile Scale 1:15840 0 3000 Feet

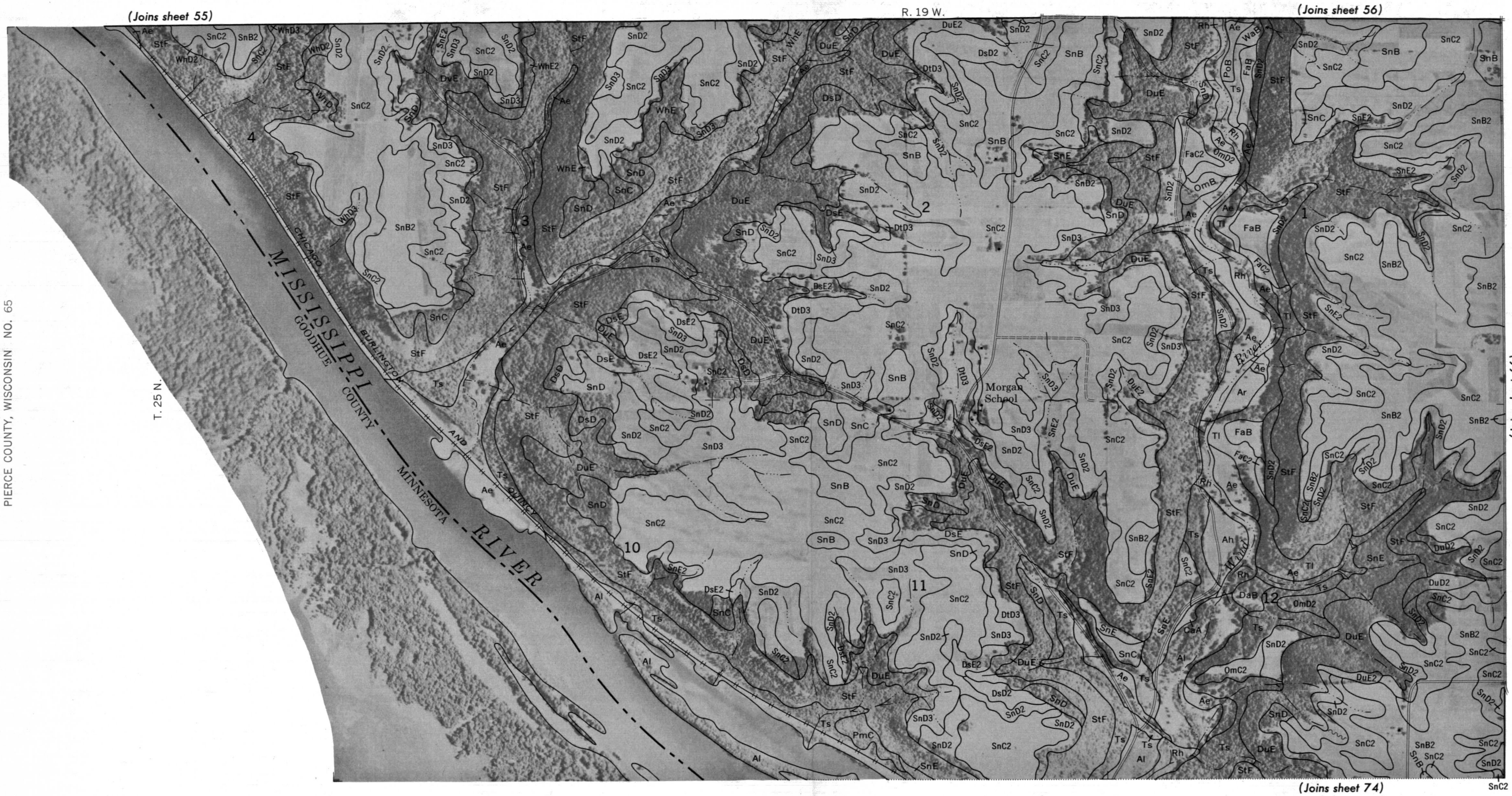
This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soil Survey Division, and Wisconsin Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

PIERCE COUNTY, WISCONSIN NO. 63



0 ½ Mile Scale 1:15840 0 3000 Feet



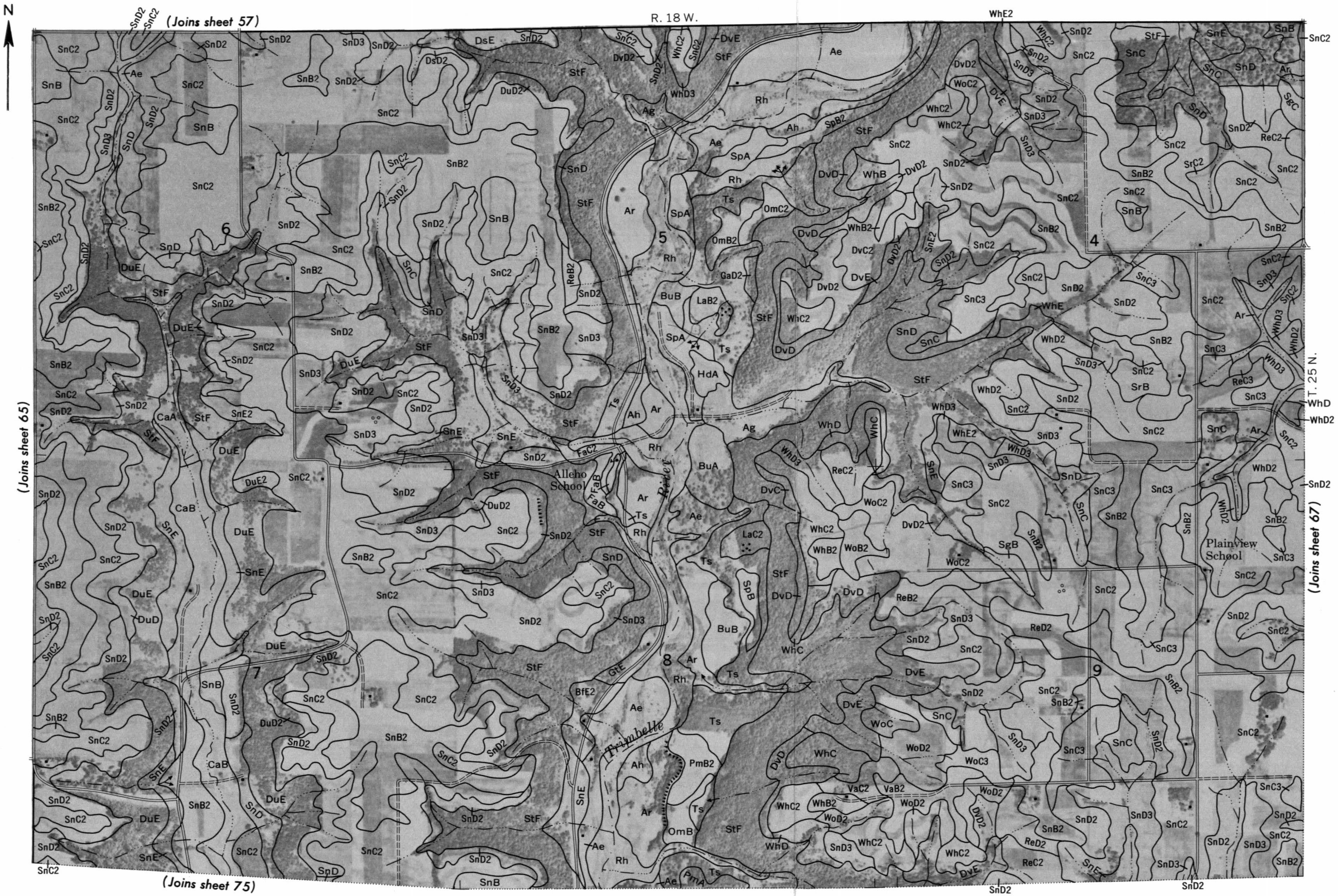
This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soil Survey Division, and Wisconsin Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

PIERCE COUNTY, WISCONSIN NO. 65

0 ½ Mile Scale 1:15840 0 3000 Feet

PIERCE COUNTY, WISCONSIN — SHEET NUMBER 66

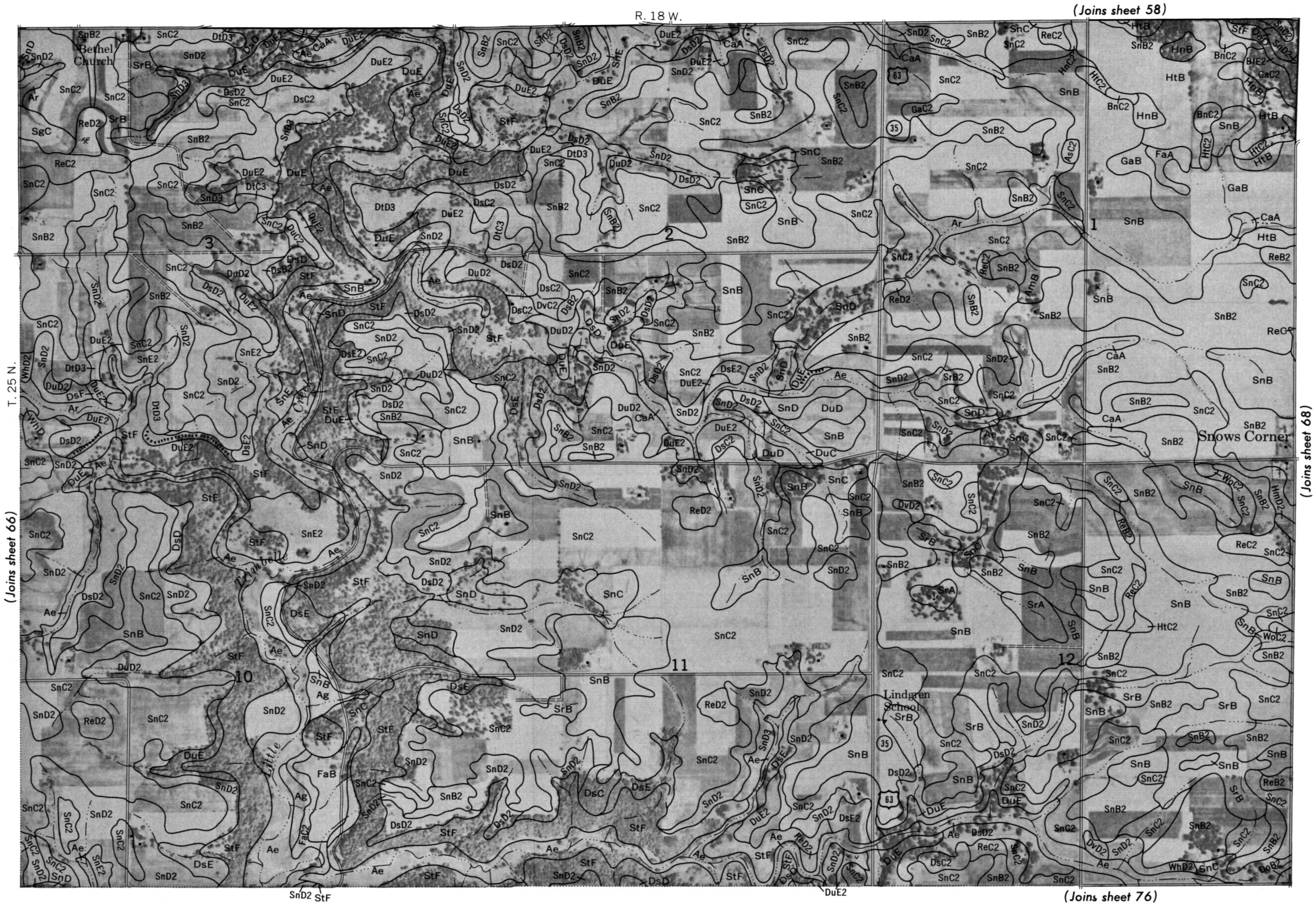


0 ½ Mile Scale 1:15840 0 3000 Feet

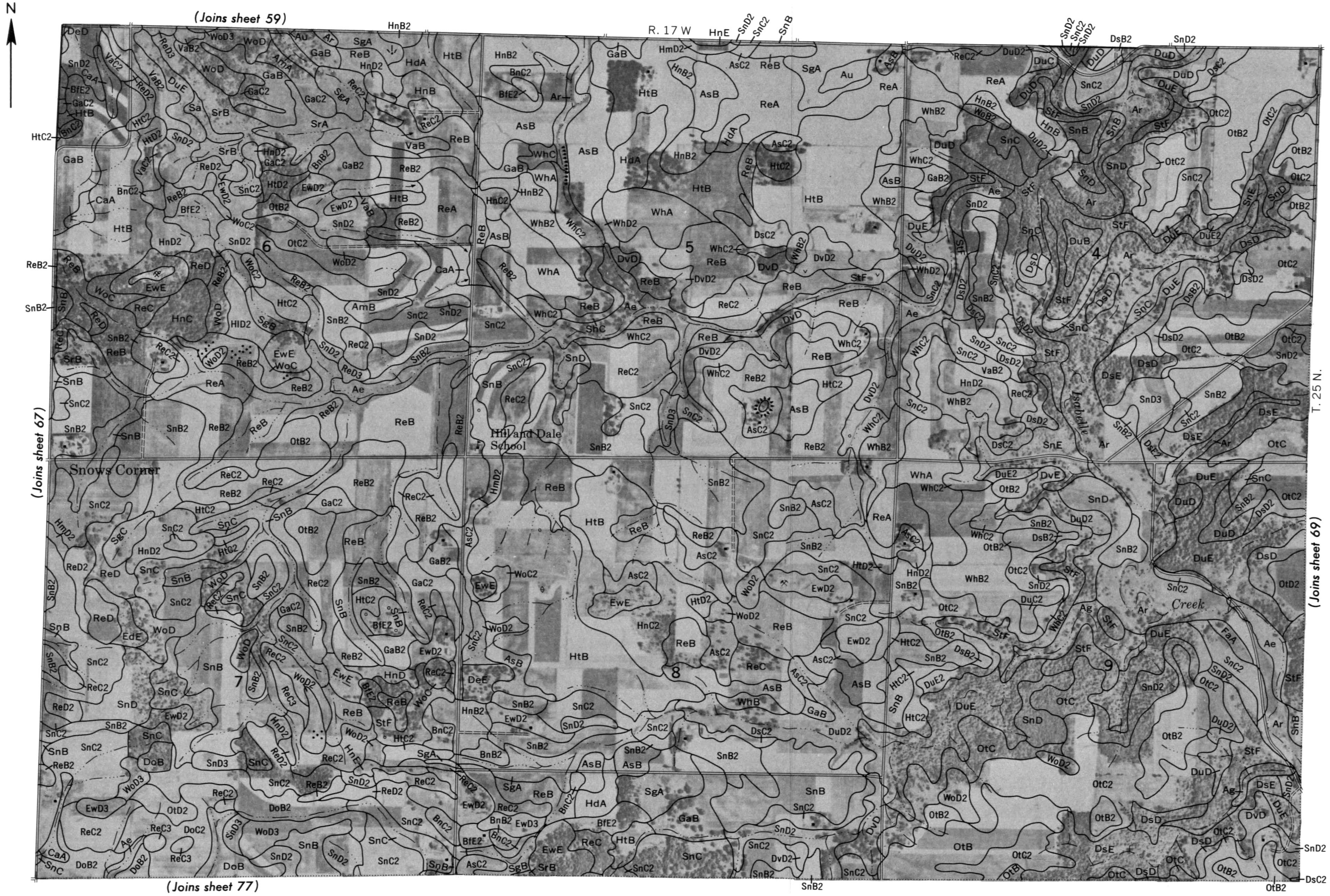
This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soil Survey Division, and Wisconsin Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

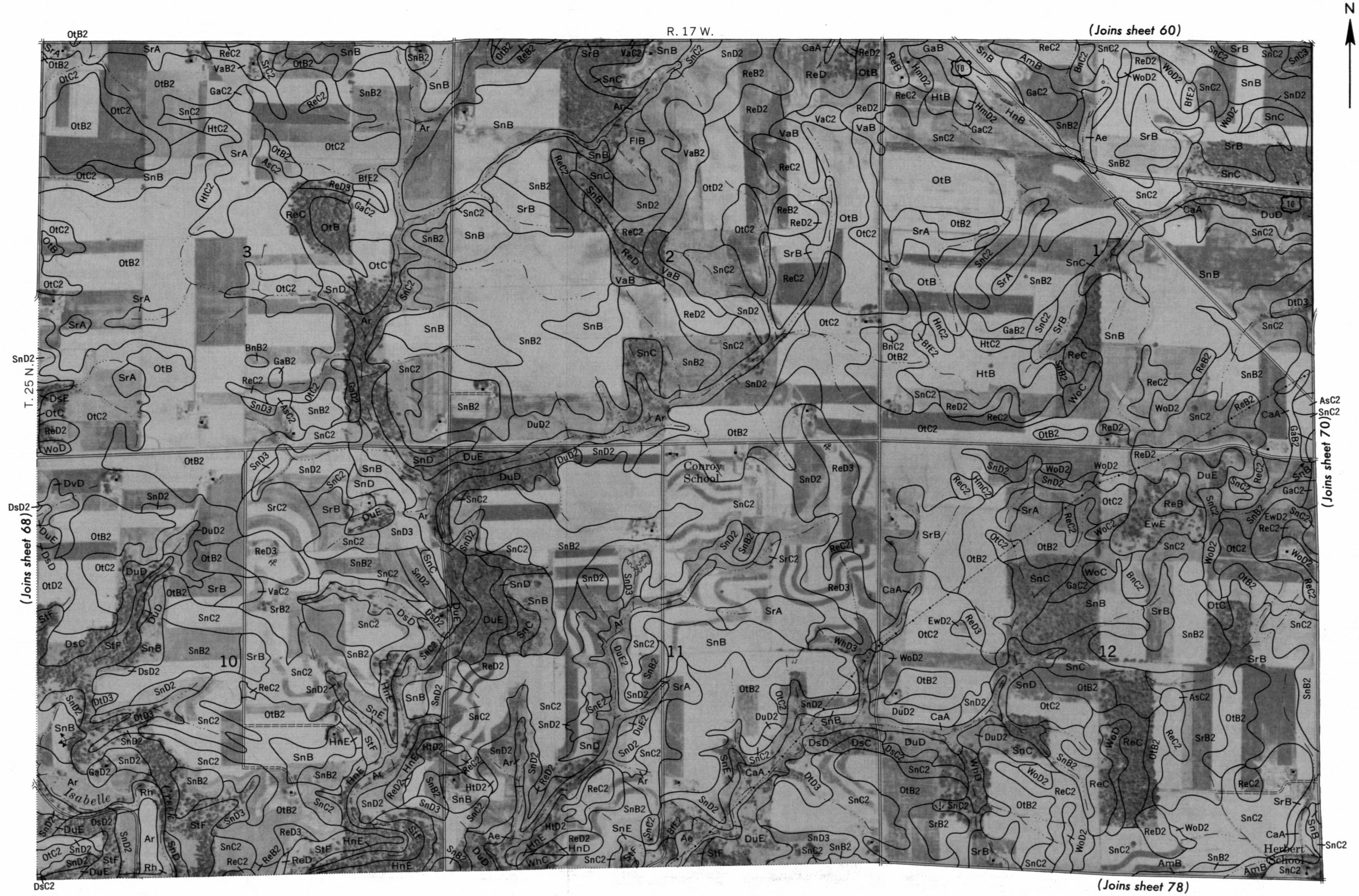
PIERCE COUNTY, WISCONSIN NO. 67



0 ½ Mile Scale 1:15840 0 3000 Feet



0 ½ Mile Scale 1:15840 0 3000 Feet



0 ½ Mile Scale 1:15840 0 3000 Feet

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Geological and Natural History Survey, Soil Survey Division, and Wisconsin Agricultural Experiment Station.

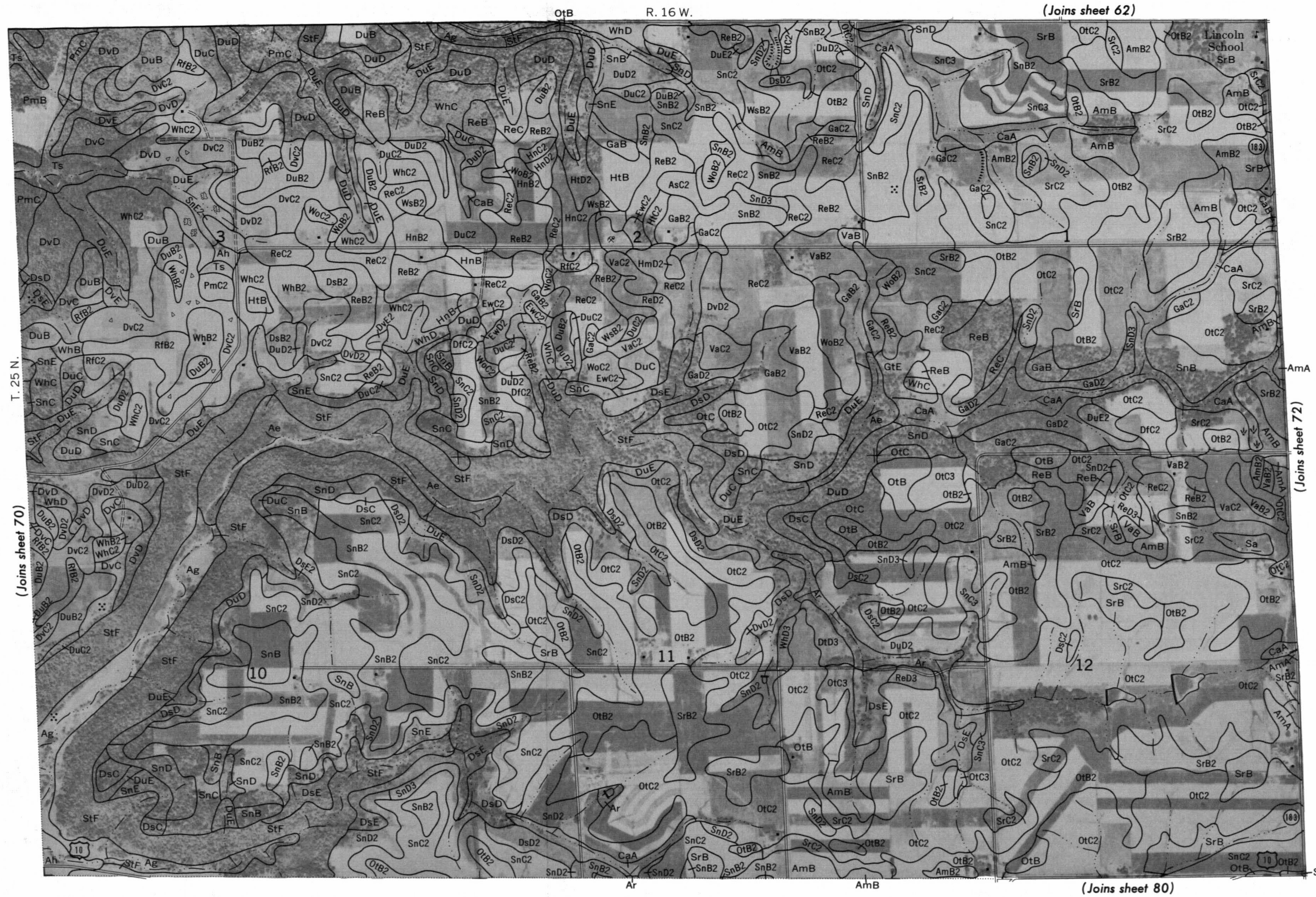
Range, township, and section corners shown on this map are indefinite.

0 ½ Mile Scale 1:15840 0 3000 Feet

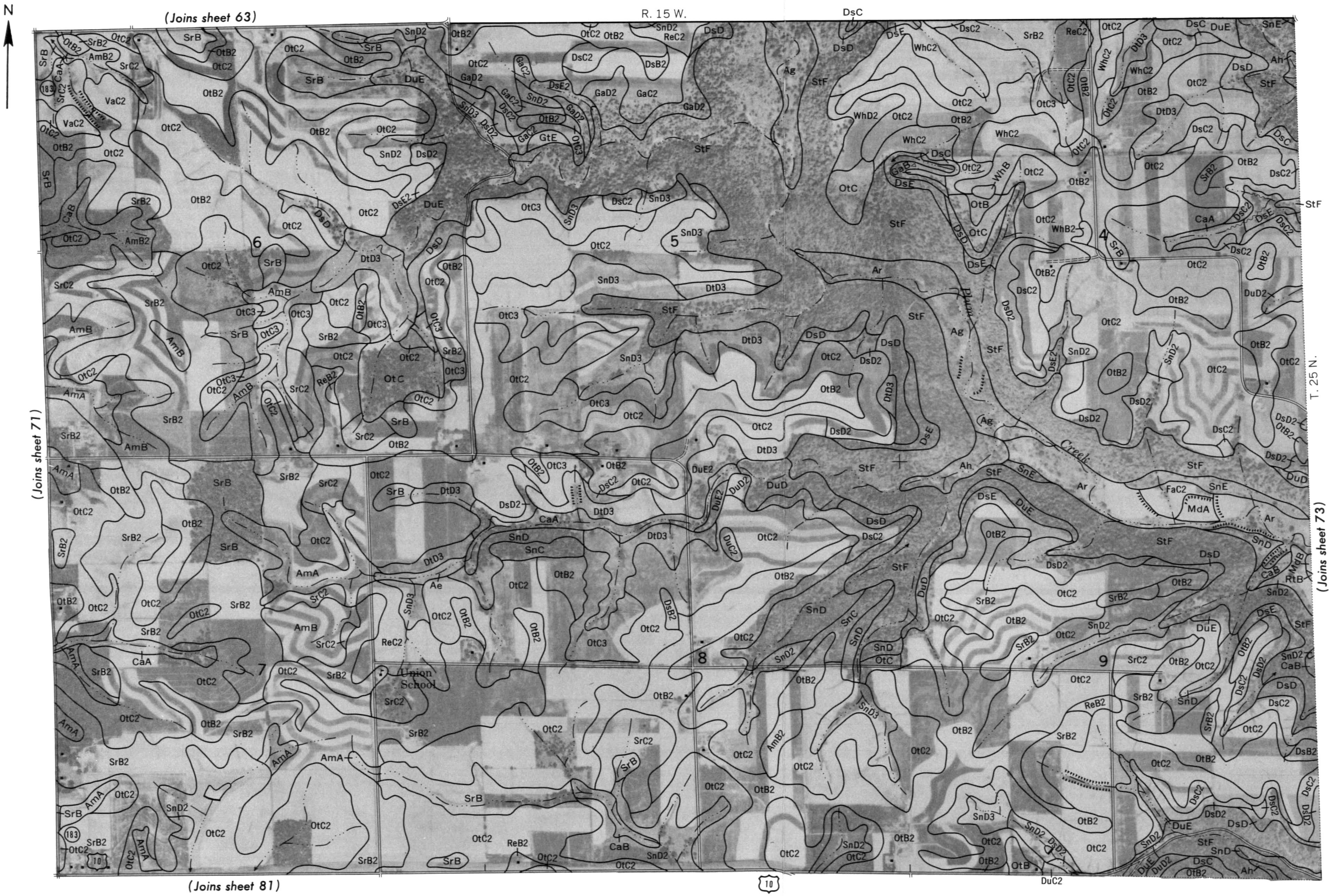
This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soil Survey Division, and Wisconsin Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

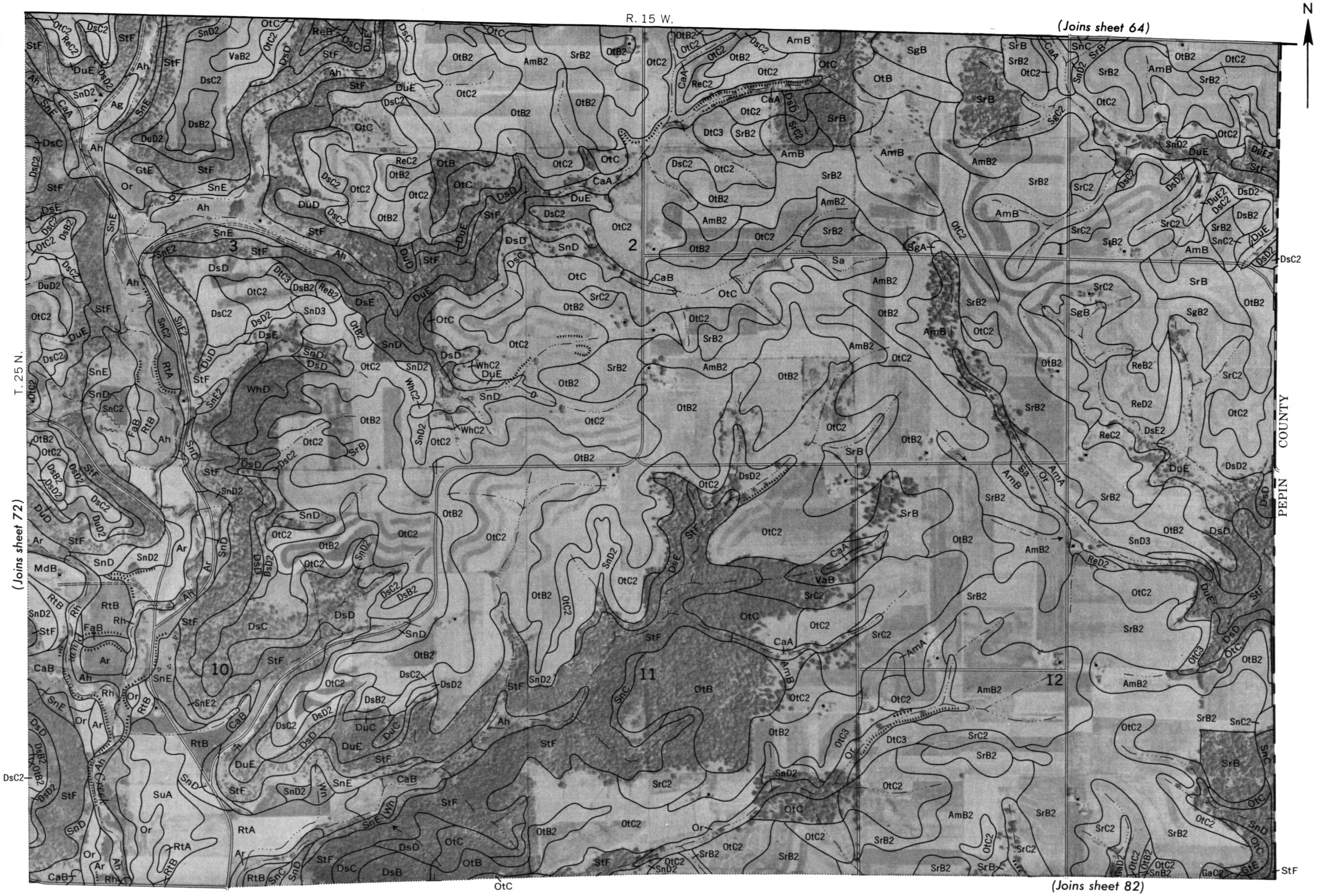
PIERCE COUNTY, WISCONSIN NO. 71



0 ½ Mile Scale 1:15840 0 3000 Feet



0 ½ Mile Scale 1:15840 0 3000 Feet



0 ½ Mile Scale 1:15840 0 3000 Feet

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soil Survey Division, and Wisconsin Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

PIERCE COUNTY, WISCONSIN NO. 73

N

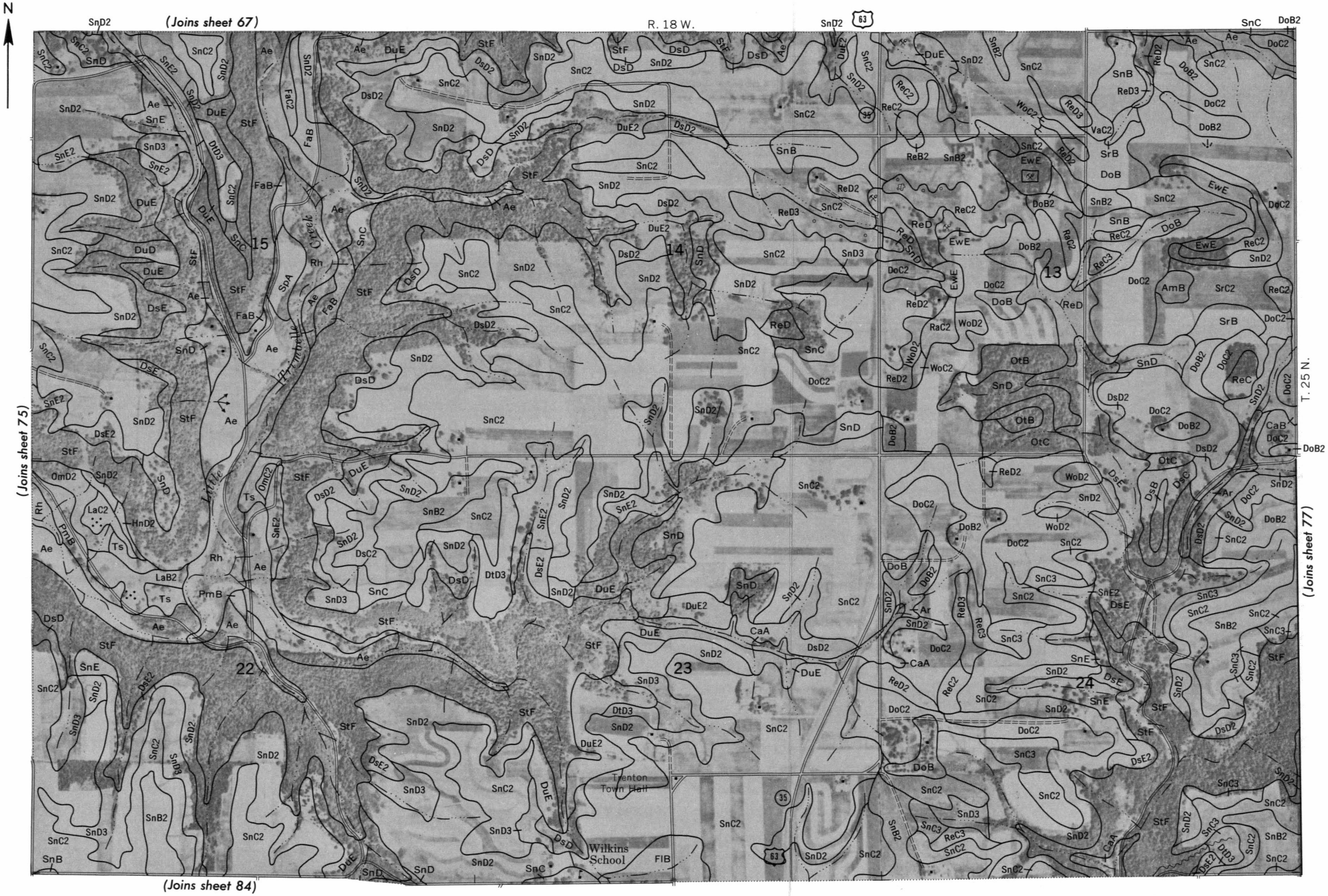
0 ½ Mile Scale 1:15840 0 3000 Feet

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soil Survey Division, and Wisconsin Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

PIERCE COUNTY, WISCONSIN NO. 75

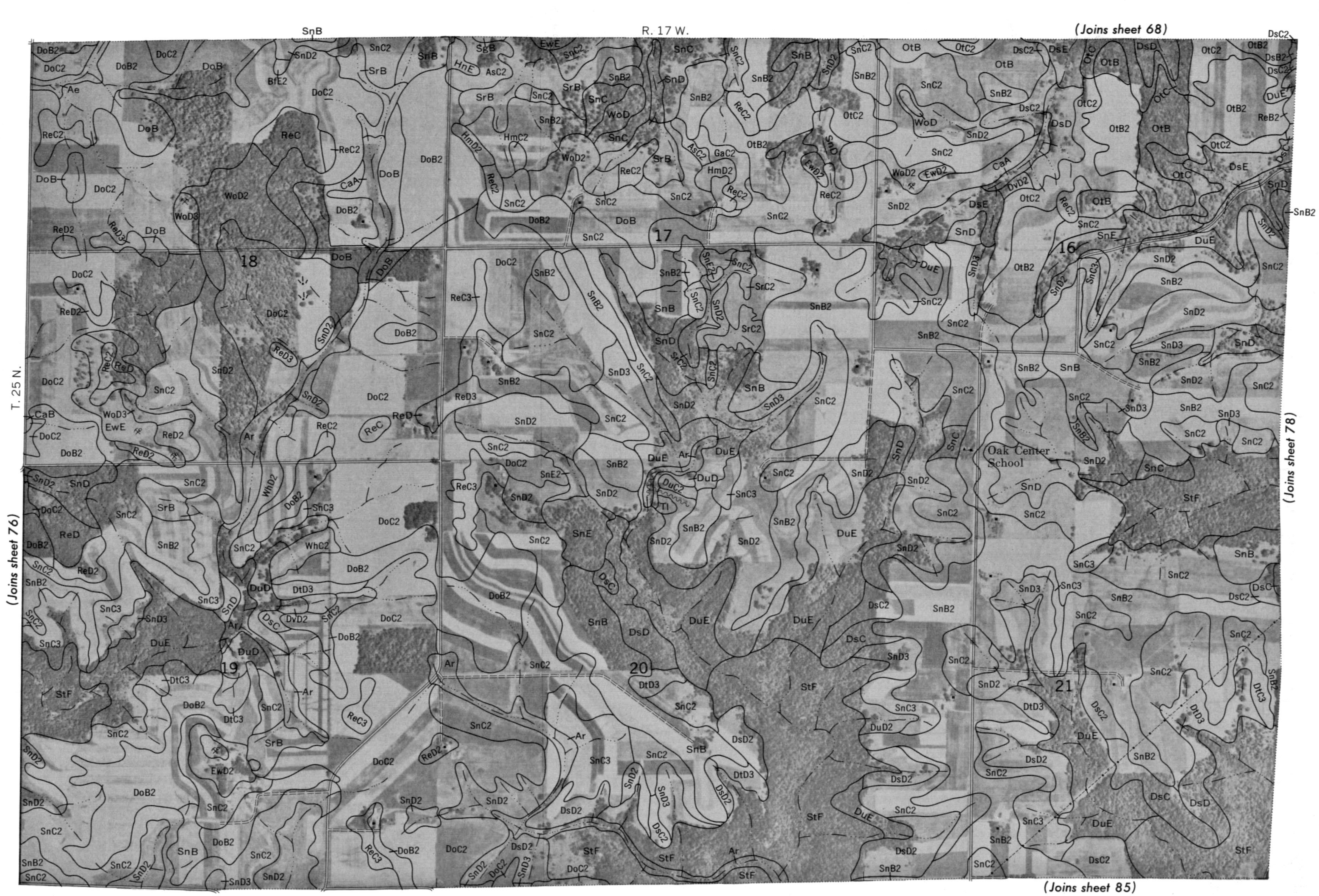
0 ½ Mile Scale 1:15840 0 3000 Feet



Scale 1:15840

0 ½ Mile

0 3000 Feet

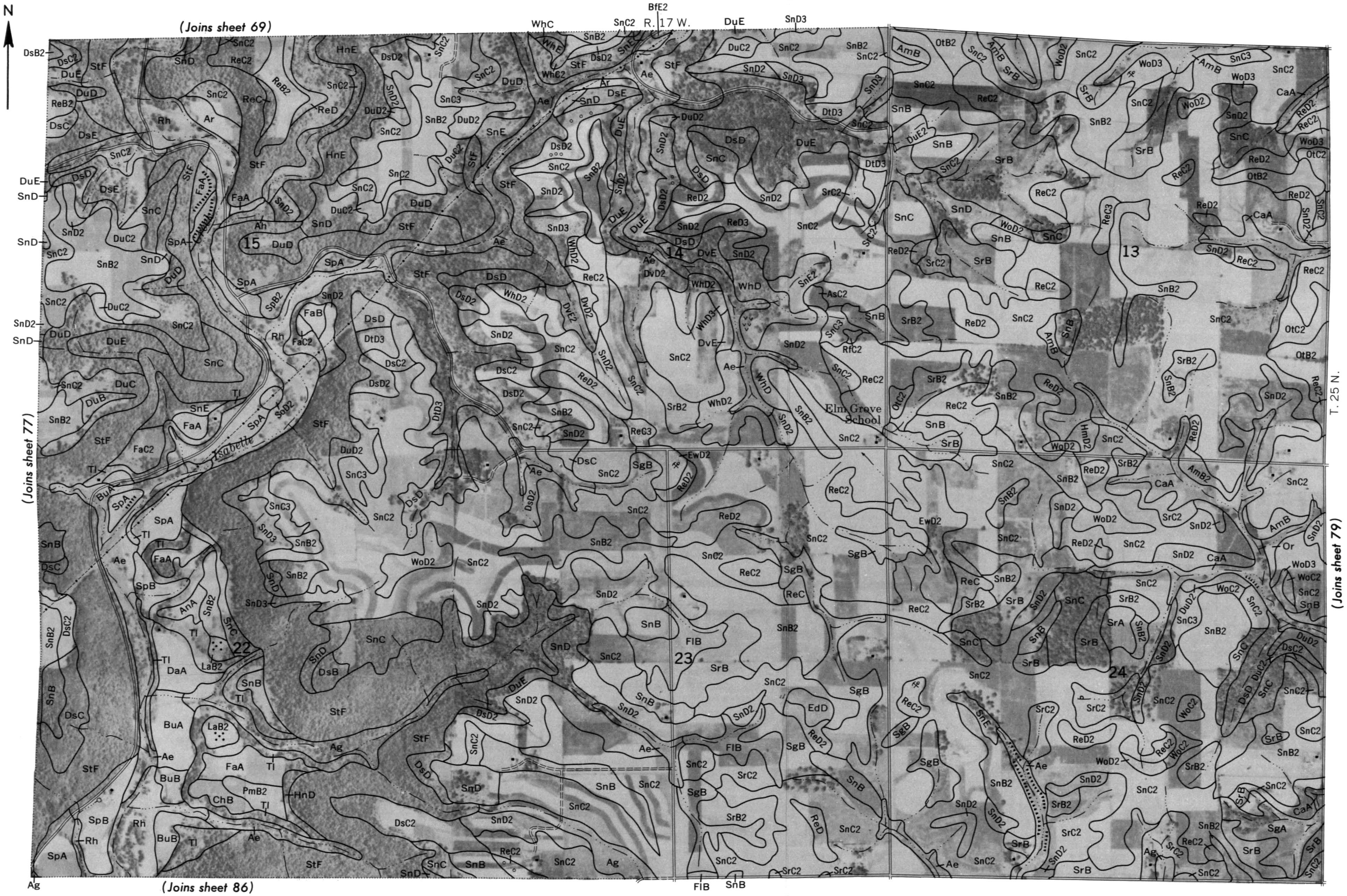


0 ½ Mile Scale 1:15840 0 3000 Feet

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soil Survey Division, and Wisconsin Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

PIERCE COUNTY, WISCONSIN — SHEET NUMBER 78



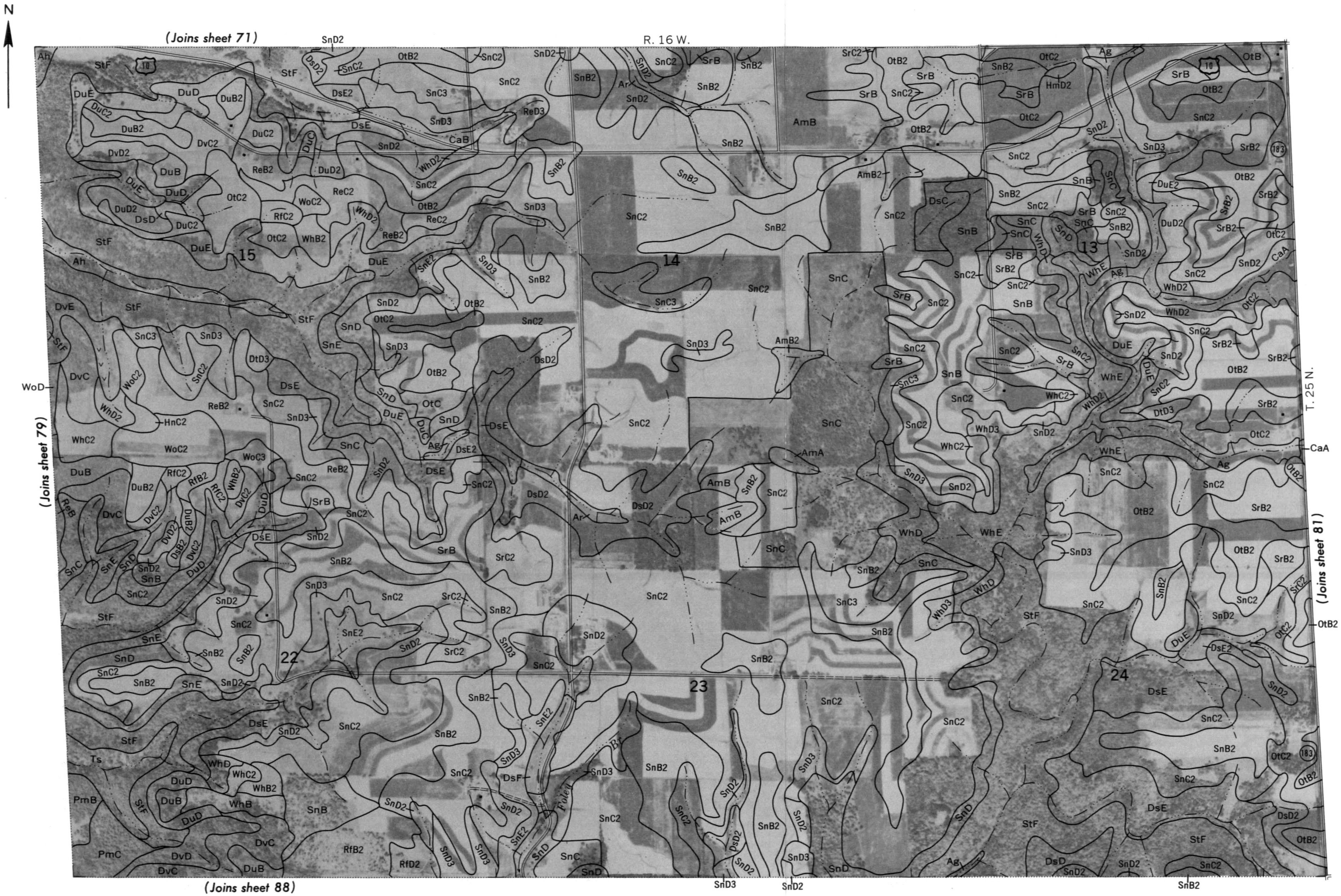
0 ½ Mile Scale 1:15840 0 3000 Feet

0 ½ Mile Scale 1:15840 0 3000 Feet

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soil Survey Division, and Wisconsin Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

PIERCE COUNTY, WISCONSIN NO. 79



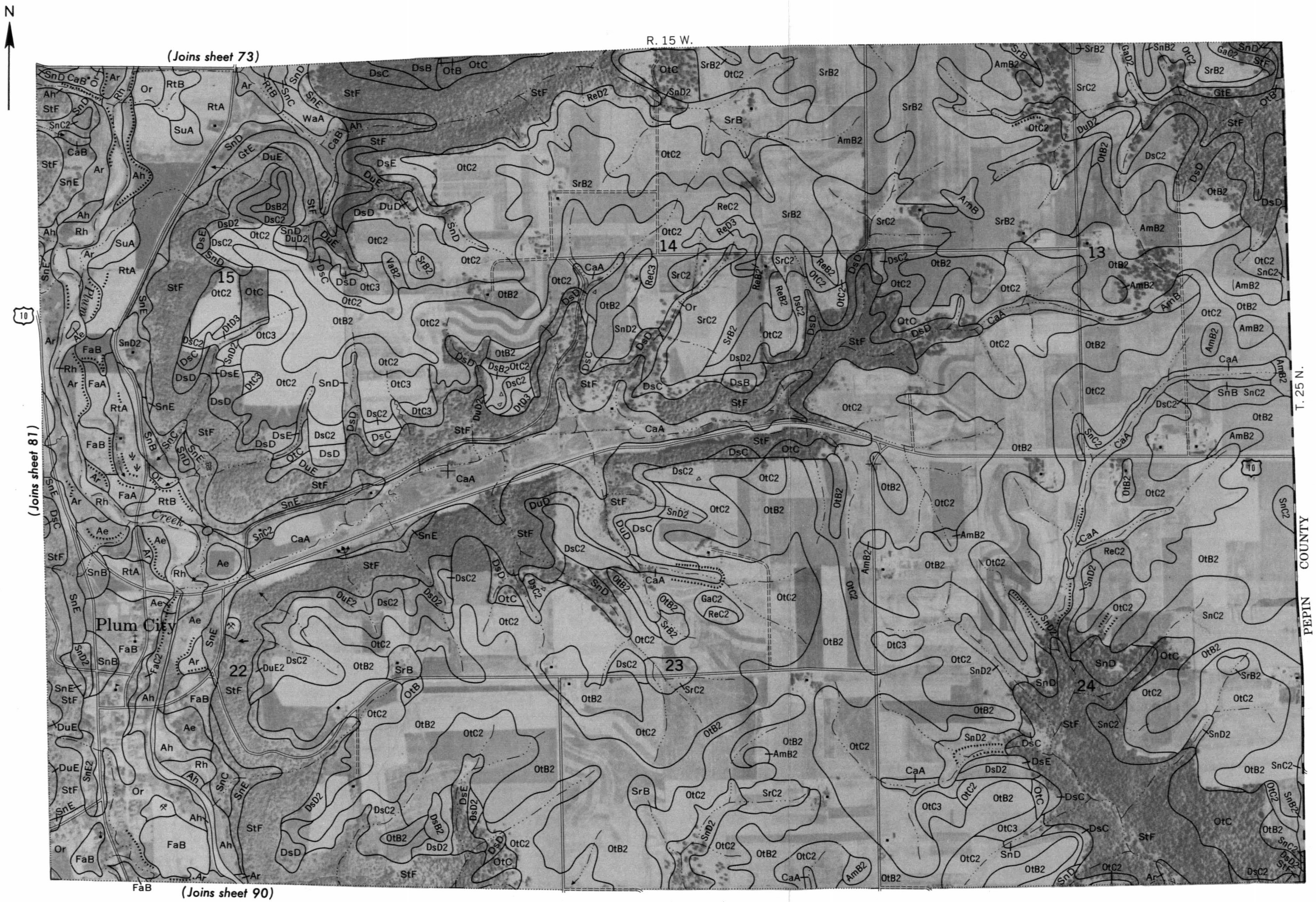
0 ½ Mile Scale 1:15840 0 3000 Feet

0 ½ Mile Scale 1:15840 0 3000 Feet

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soil Survey Division, and Wisconsin Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

PIERCE COUNTY, WISCONSIN NO. 81



0 ½ Mile Scale 1:15840 0 3000 Feet

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soil Survey Division, and Wisconsin Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

PIERCE COUNTY, WISCONSIN NO. 83

0 ½ Mile Scale 1:15840 0 3000 Feet

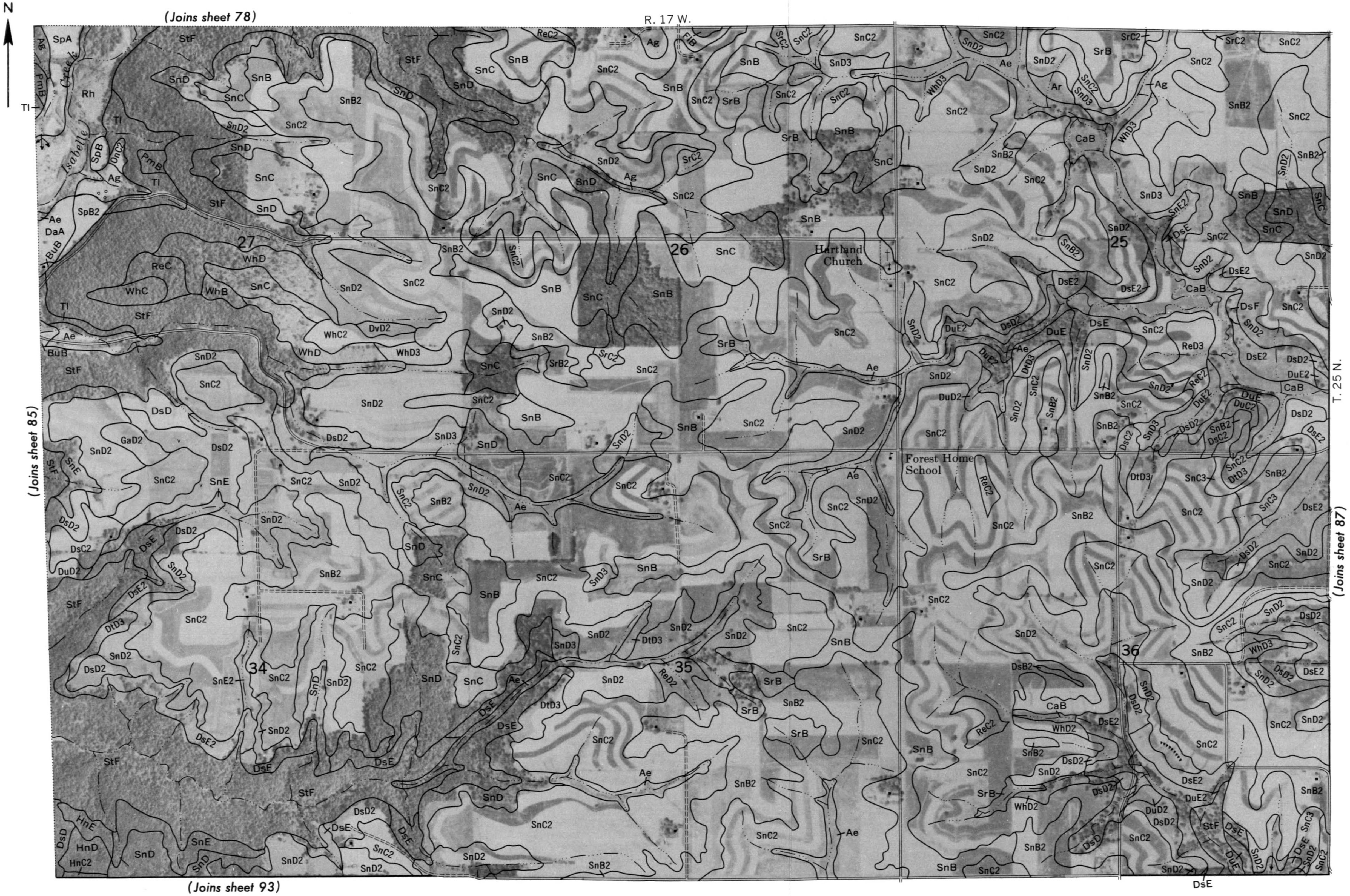
0 ½ Mile Scale 1:15840 0 3000 Feet

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soil Survey Division, and Wisconsin Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

PIERCE COUNTY, WISCONSIN NO. 85

0 ½ Mile Scale 1:15840 0 3000 Feet



0 ½ Mile Scale 1:15840 0 3000 Feet

N

0 ½ Mile Scale 1:15840 0 3000 Feet

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soil Survey Division, and Wisconsin Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

Scale 1:15840

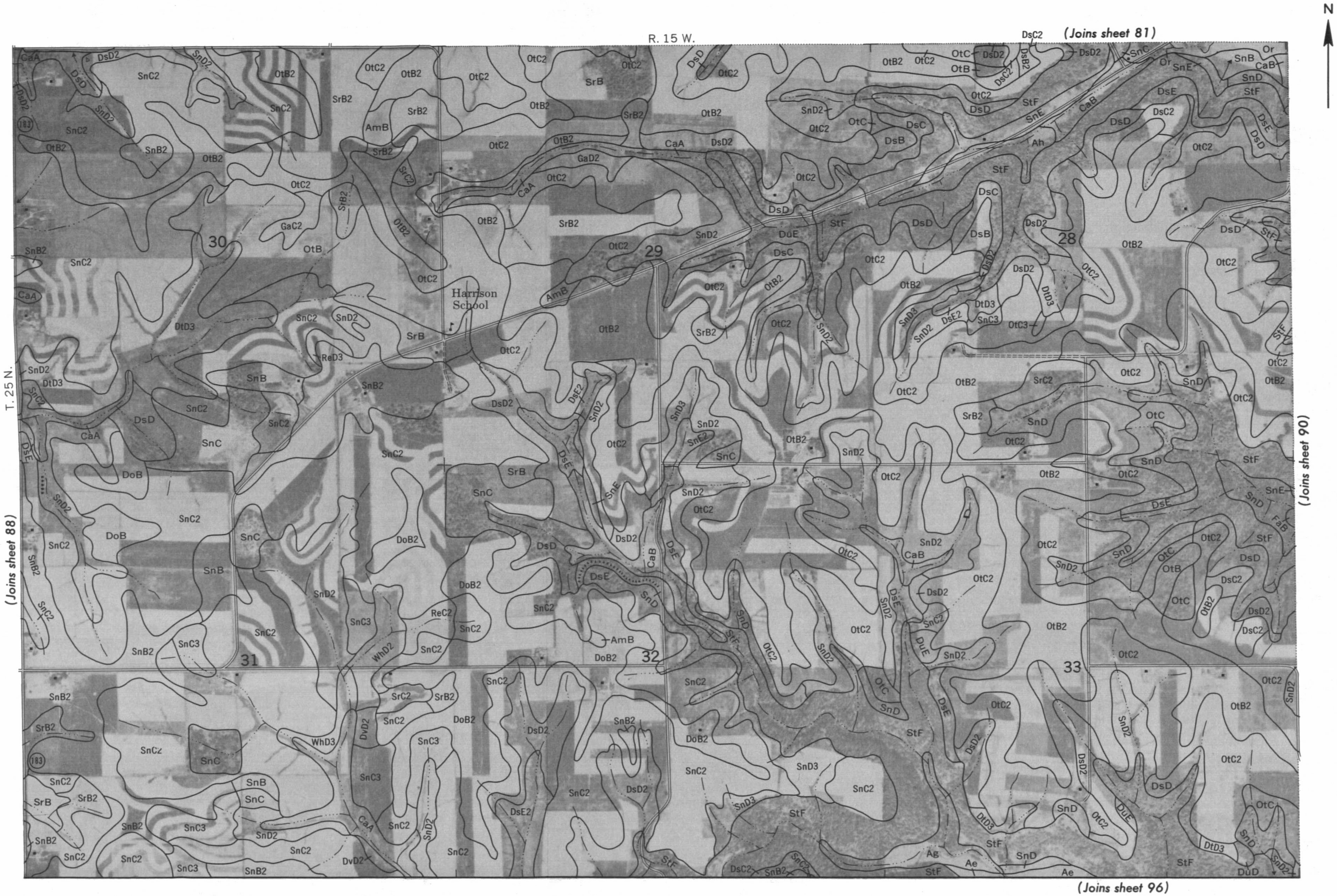
0 ½ Mile

0 3000 Feet

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soil Survey Division, and Wisconsin Agricultural Experiment Station.

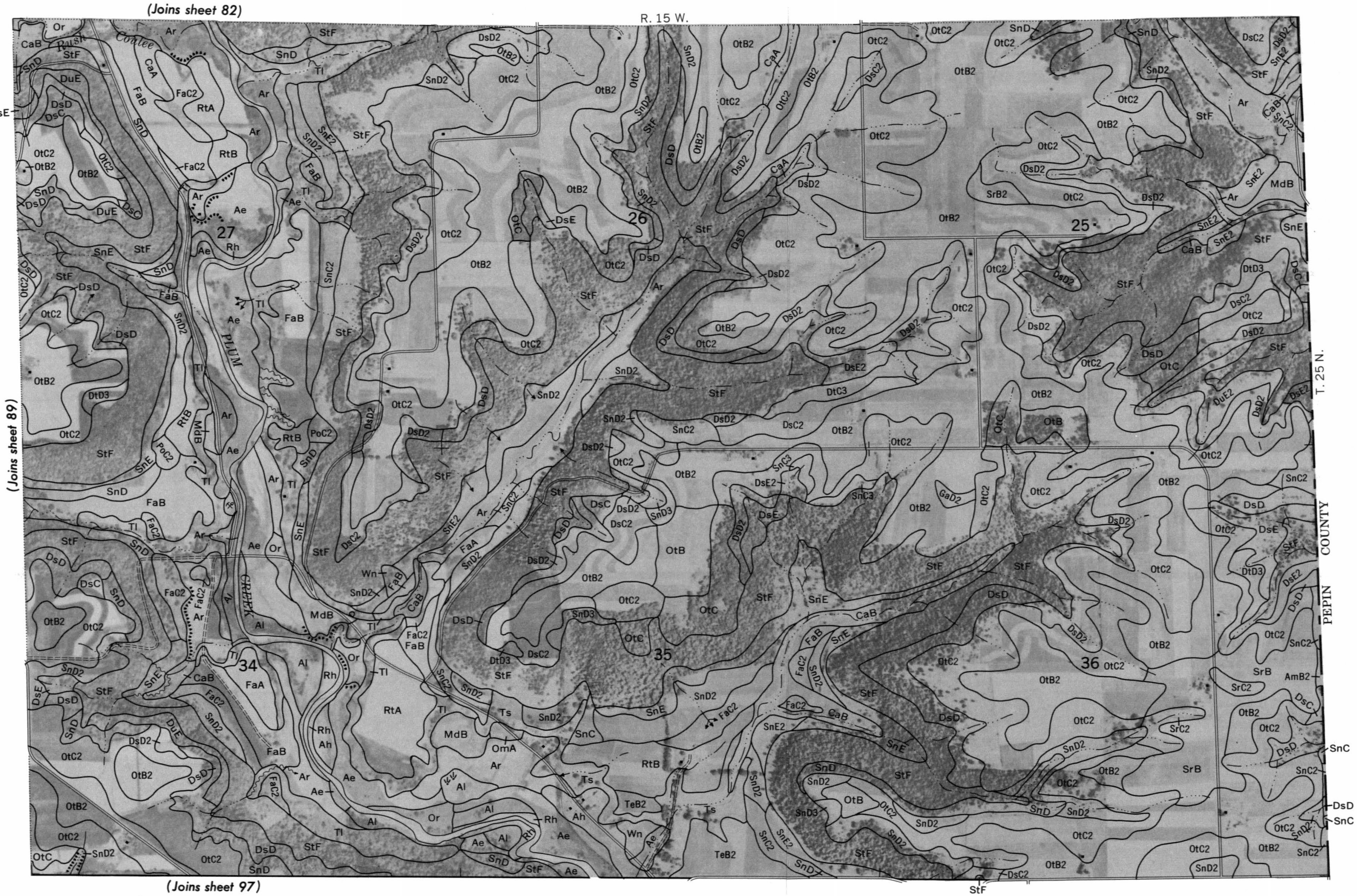
Range, township, and section corners shown on this map are indefinite.

PIERCE COUNTY, WISCONSIN NO. 89



0 ½ Mile Scale 1:15840 0 3000 Feet

N



0 ½ Mile Scale 1:15840 0 3000 Feet

(Joins sheet 83)

(Joins sheet 84)

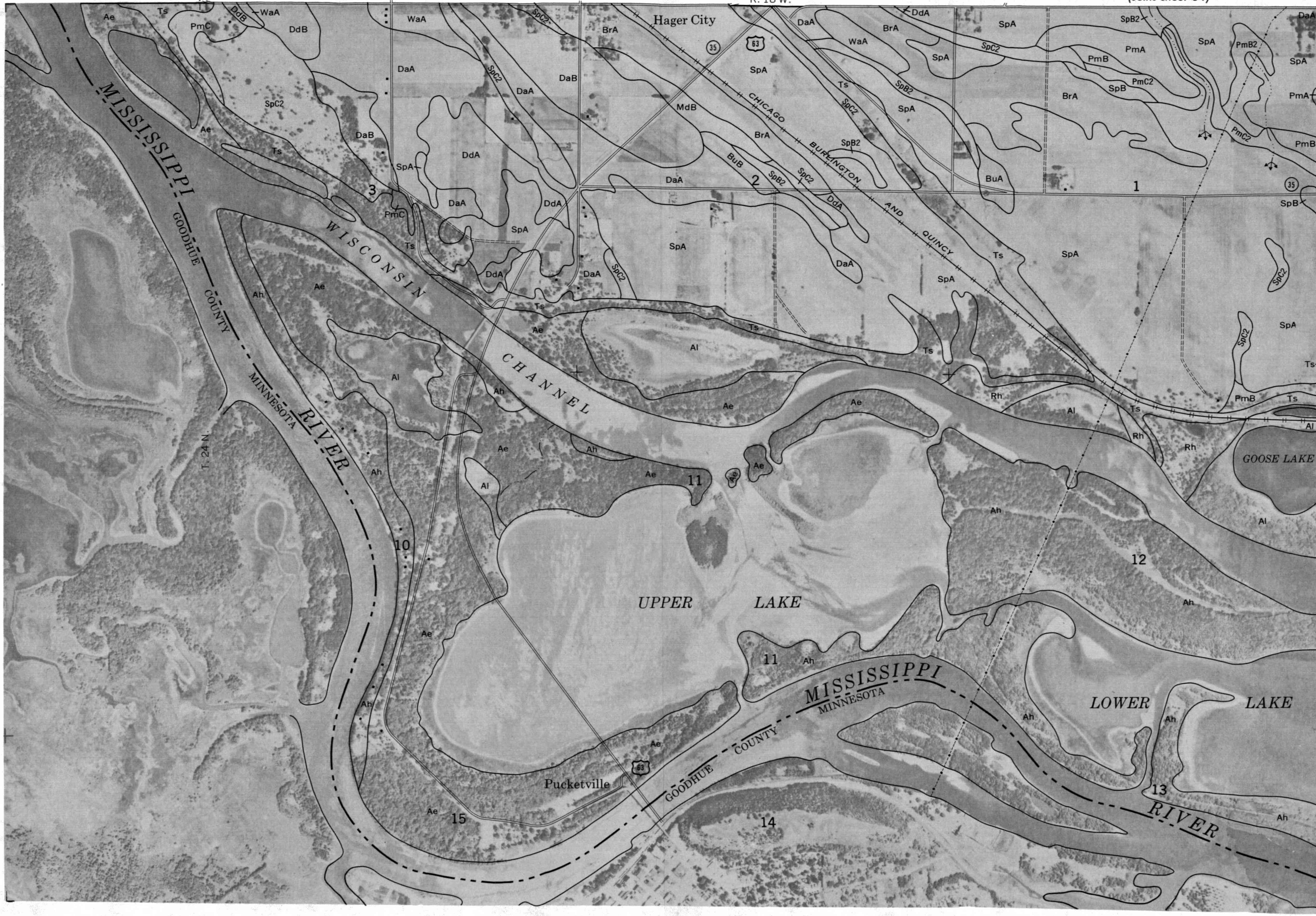
(Joins sheet 92)

(Joins sheet 98)

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soil Survey Division, and Wisconsin Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

PIERCE COUNTY, WISCONSIN NO. 91

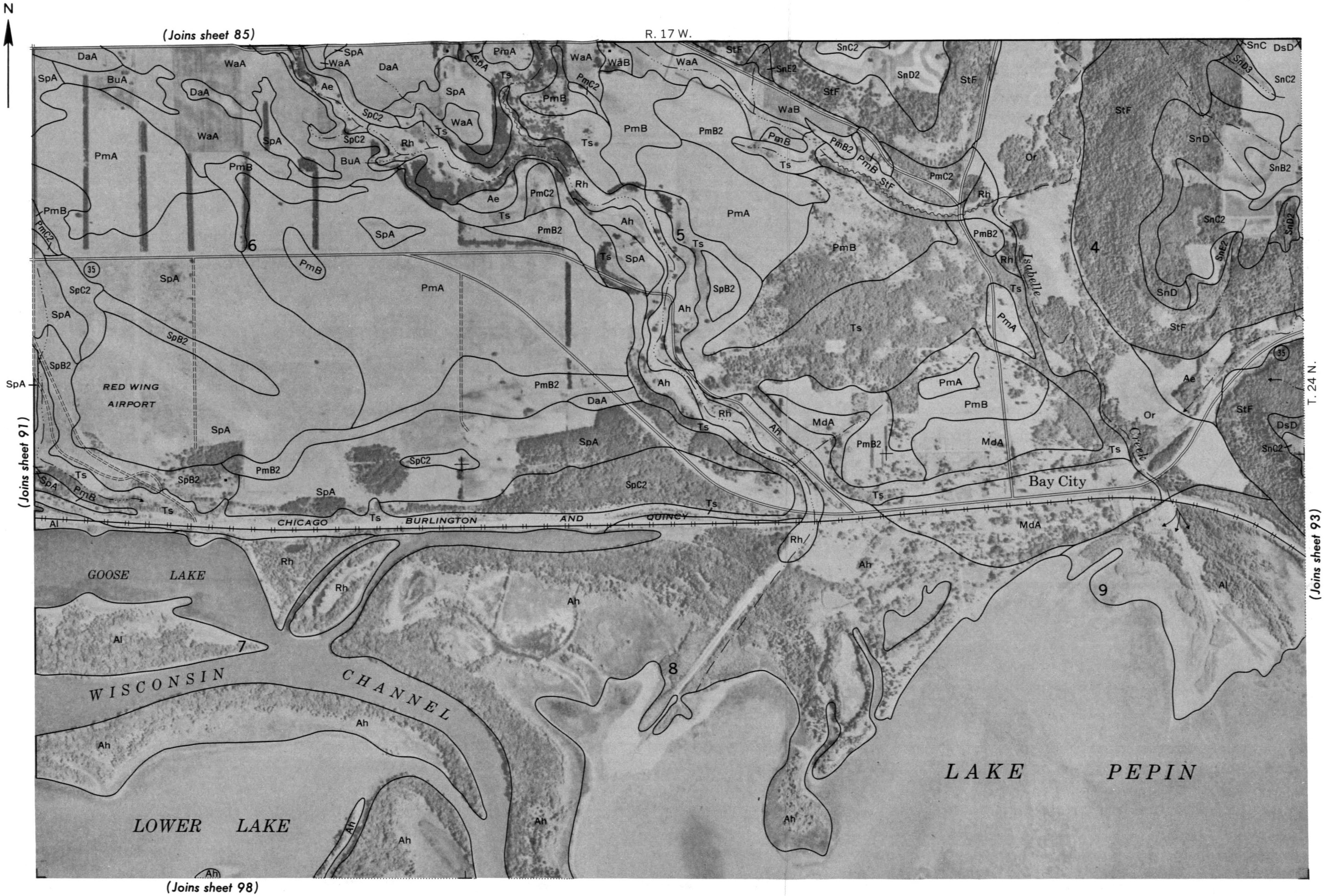


0 ½ Mile

Scale 1:15840

0 3000 Feet

92



0 ½ Mile Scale 1:15840 0 3000 Feet

(Joins sheet 86)

(Joins sheet 92)

(Joins sheet 98) | (Joins sheet 92)

(Joins sheet 99) | (Joins sheet 94)

0 ½ Mile Scale 1:15840 0 3000 Feet

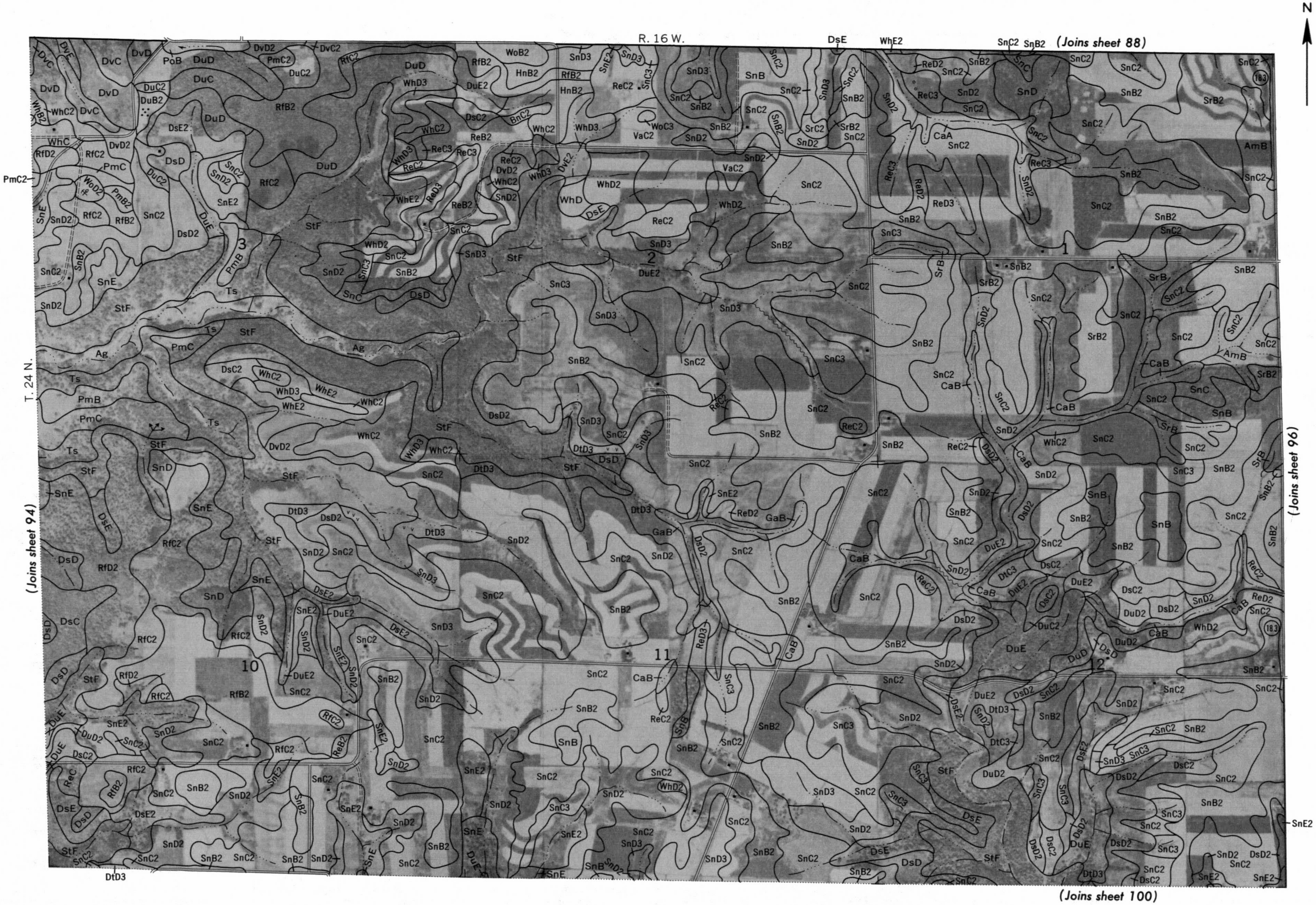
This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soil Survey Division, and Wisconsin Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

PIERCE COUNTY, WISCONSIN NO. 93

N

0 ½ Mile Scale 1:15840 0 3000 Feet



0 ½ Mile Scale 1:15840 0 3000 Feet

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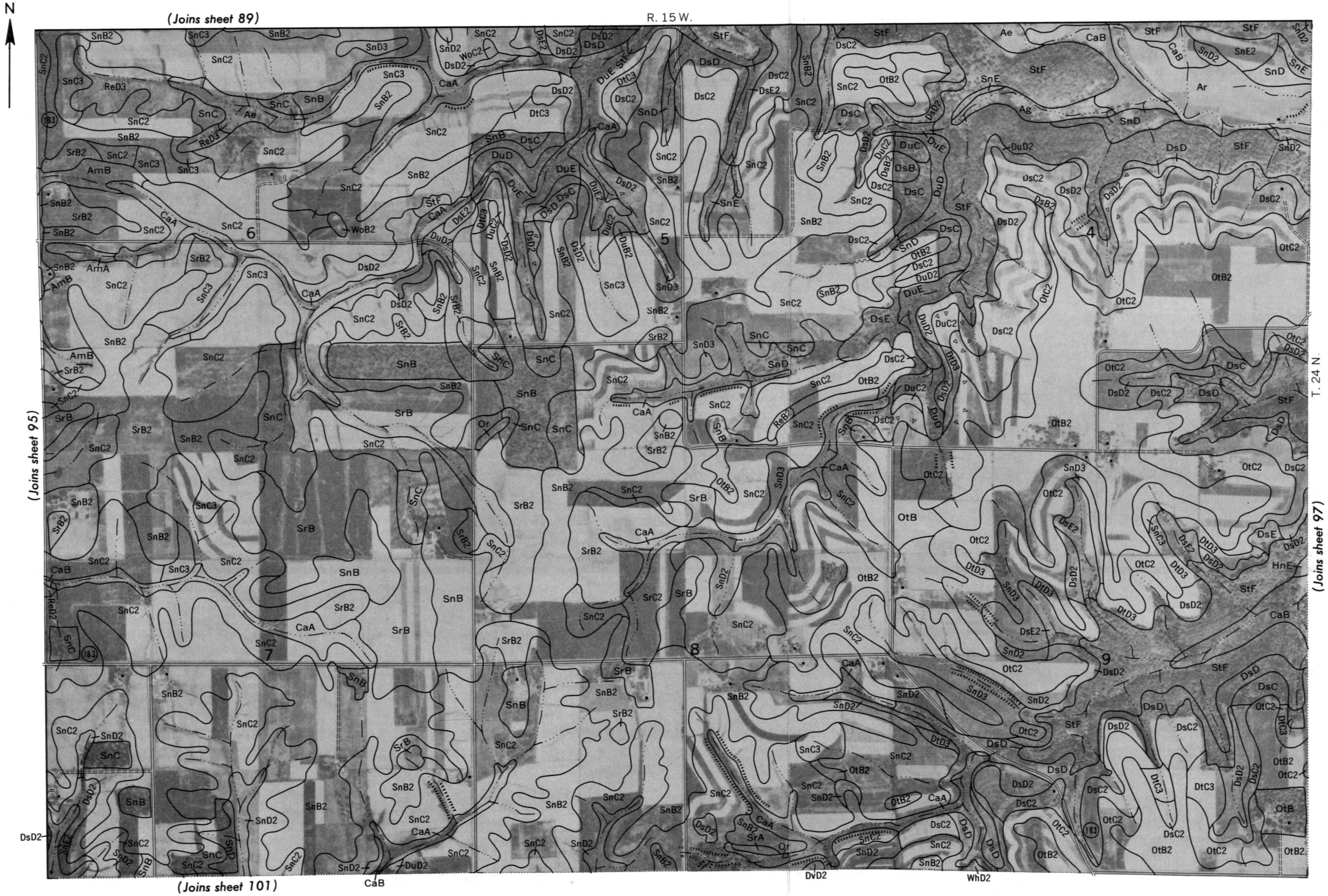
Range, township, and section corners shown on this map are indefinite.

PIERCE COUNTY, WISCONSIN NO. 95



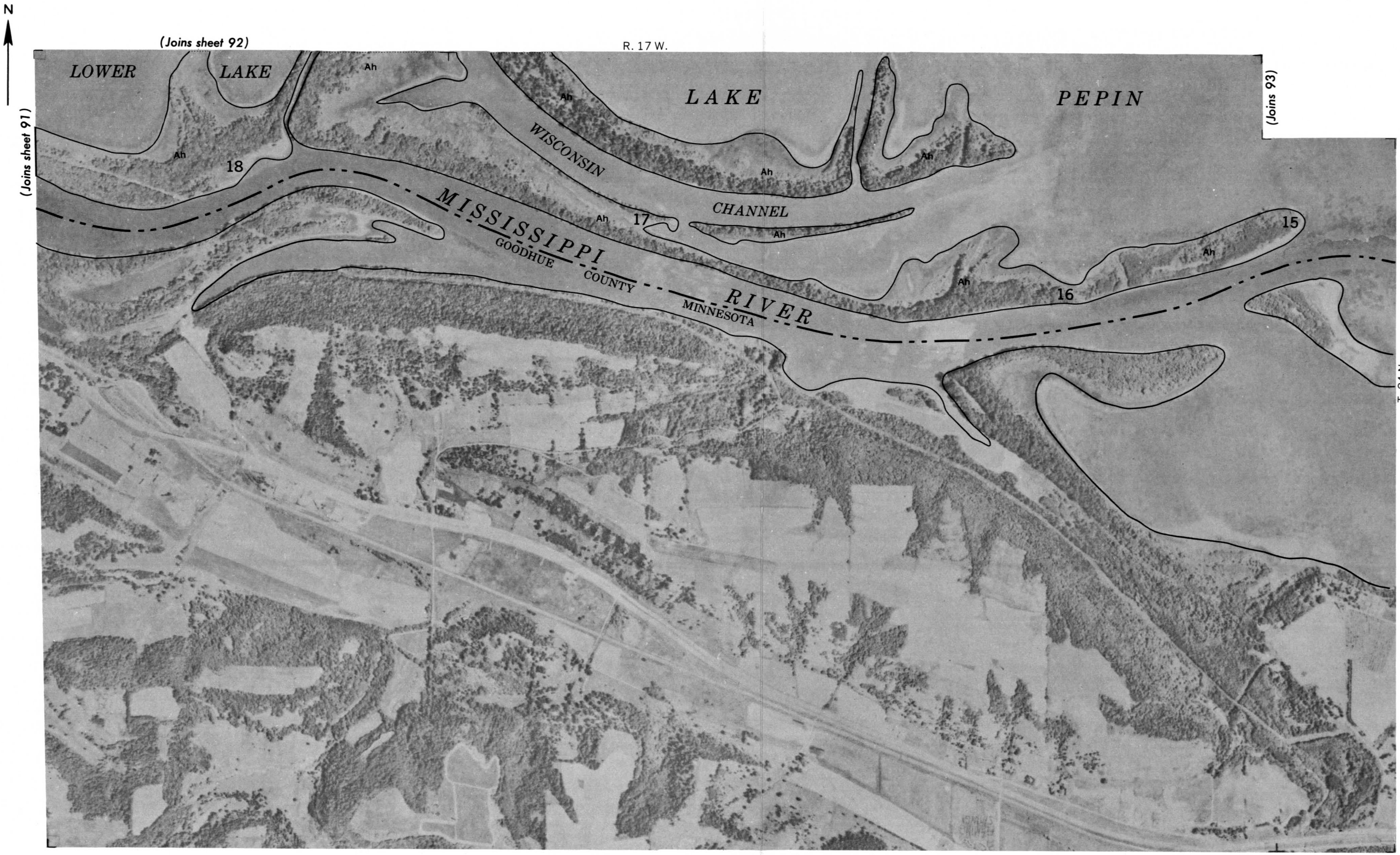
0 ½ Mile Scale 1:15840 0 3000 Feet

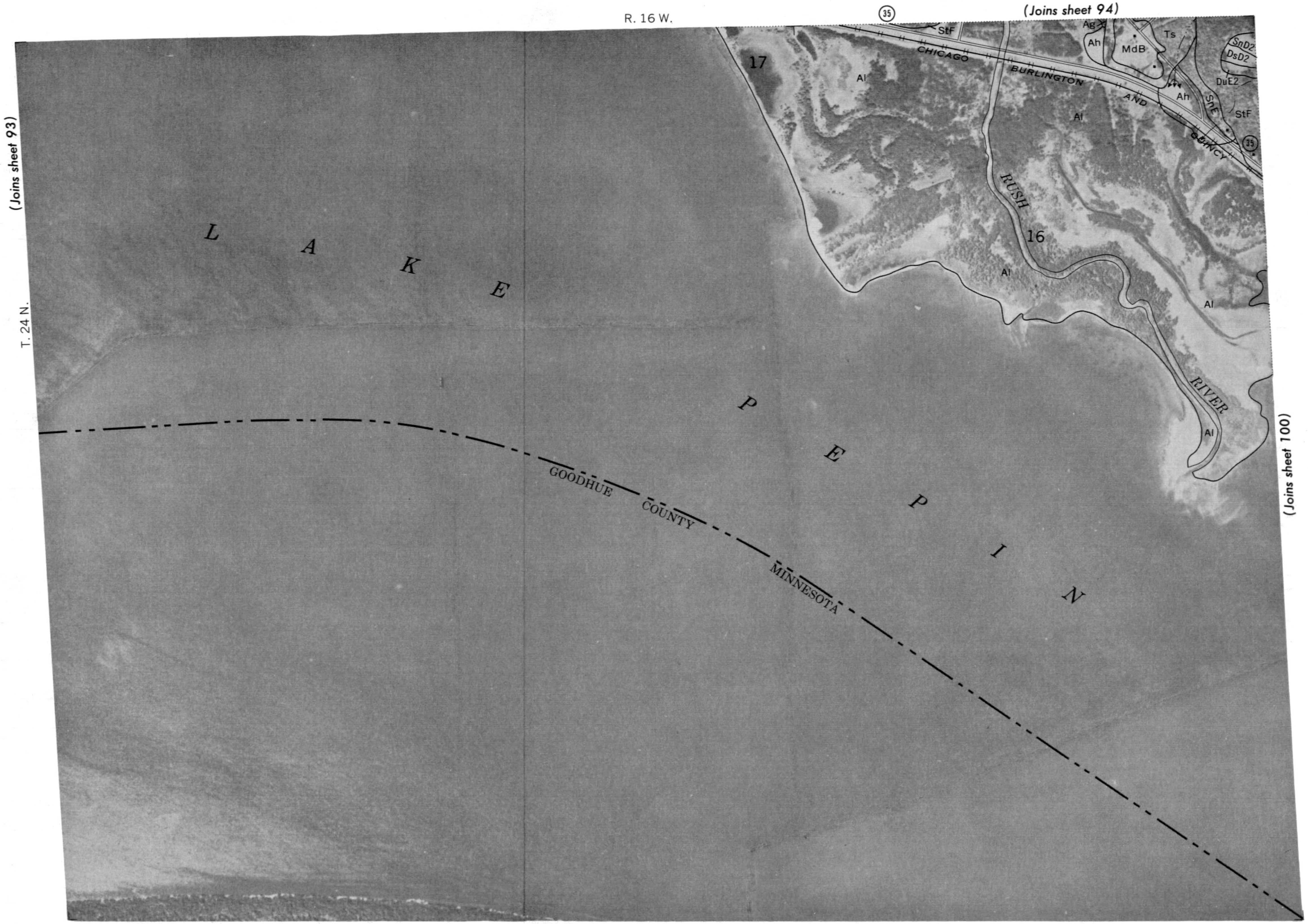
This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soil Survey Division, and Wisconsin Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

PIERCE COUNTY, WISCONSIN NO. 97

0 ½ Mile Scale 1:15840 0 3000 Feet


N
(Joins sheet 92)
R. 17 W.
(Joins sheet 91)
(Joins 93)
LOWER LAKE
LAKE PEPIN
WISCONSIN CHANNEL
MISSISSIPPI RIVER
GOODHUE COUNTY
MINNESOTA
Ah
18
17
16
15
T. 24 N.



0 ½ Mile Scale 1:15840 0 3000 Feet

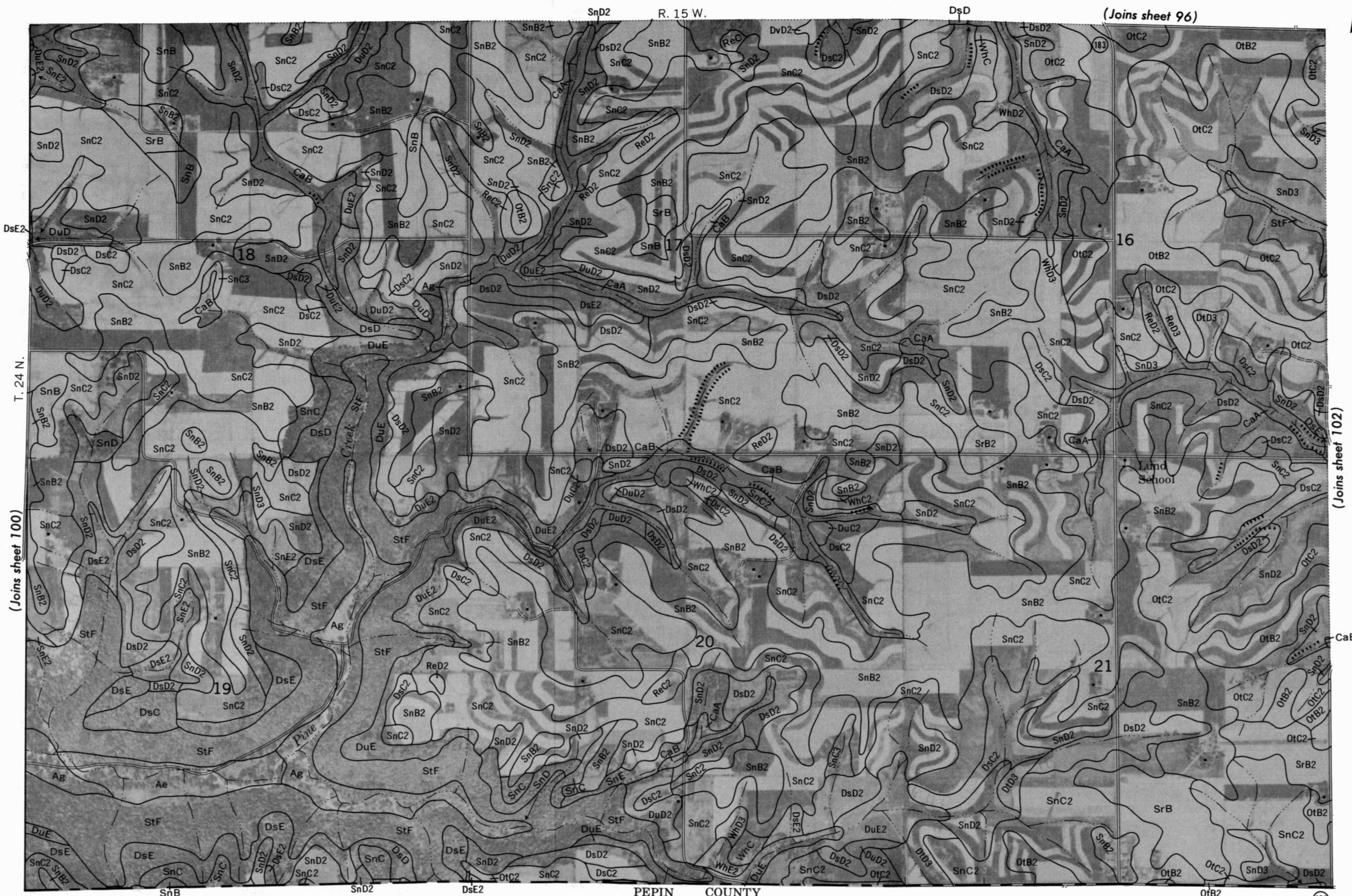
The map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin, Wisconsin Geological and Natural History Survey, Soil Survey Division, and Wisconsin Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

PIERCE COUNTY, WISCONSIN NO. 99

(100)

0 ½ Mile Scale 1:15840 0 3000 Feet



0 ½ Mile Scale 1:15840 0 3000 Feet

map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Wisconsin Wisconsin Geological and Natural History Survey, Soil Survey Division, and Wisconsin Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

PIERCE COUNTY, WISCONSIN NO. 101

0 ½ Mile Scale 1:15840 0 3000 Feet